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NOVEMBER 1925

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Vol. XIV
No. 11

INDUSTRIAL-ARTS MAGAZINE

November,
1925

Incorporating: HANDICRAFT and the ARTS AND CRAFTS MAGAZINE

Published Monthly by
THE BRUCE PUBLISHING CO.
354-364 MILWAUKEE STREET
MILWAUKEE, WIS.

NEW YORK: 30 CHURCH STREET

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Let Us Be Thankful

WASHINGTON in the first presidential proclamation of a Day of Public Thanksgiving called attention to the "duty of all nations to acknowledge the Providence of Almighty God, to obey His Will, to be grateful for His Benefits and to humbly implore His Protection and Favour."

In that reverential spirit every teacher may well approach Thanksgiving, 1925, and be truly grateful for the benefits which we as a people and as individuals have enjoyed this year.

It is no exaggeration to say that we are the happiest, the most peaceful, the most blessed nation on earth. Well may we be truly and humbly thankful to God.

SERVICE APPRECIATED

I received the filing index this morning, and found immediate use for it. It has been my custom for years to file material pertinent to the industrial arts field in education. I believe that in sending out your filing index you will initiate a habit for many that all teachers should have.

Your keenness to be of real service to your subscribers is highly appreciated.

L. F. ASHLEY, Charleston, Ill.

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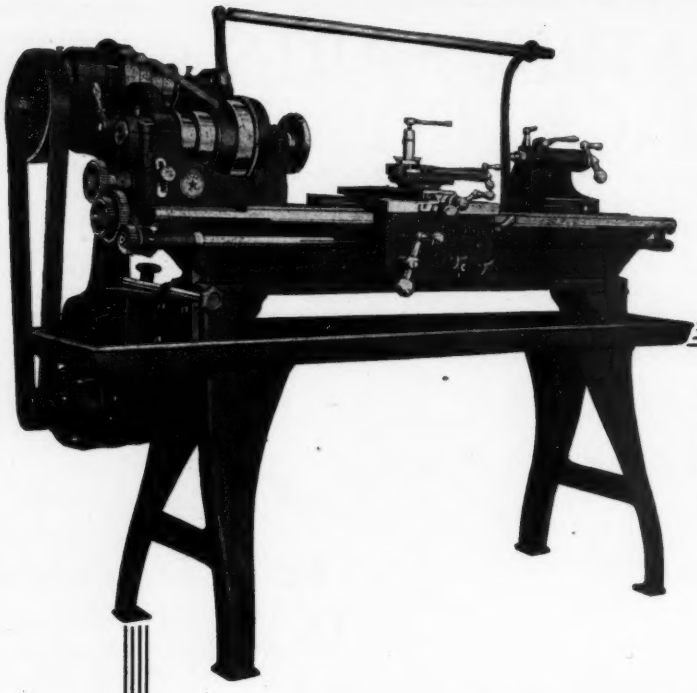
SUBSCRIPTION INFORMATION—Subscription price, $2.50 per year, payable in advance. Canadian and Mexican postage, 35 cents, foreign countries, 50 cents. Copies not over three months old, 30 cents; more than three months, 50 cents. Notice for discontinuance of subscription must reach Publication Office in Milwaukee, at least fifteen days before date of expiration. Changes of address should invariably include old as well as new address. Complaint of non-receipt of subscribers' copies cannot be honored unless made within fifteen days after date of issue.

EDITORIAL CONTRIBUTIONS—The Editors invite contributions bearing upon Industrial-Arts Education, Manual Training, Art, Domestic Science, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

The Magazine is on sale at Brentano's, New York; Wanamaker's, Philadelphia; Brentano's, Chicago.



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THE INDUSTRIAL ARTS MAGAZINE

Volume XIV NOVEMBER, 1925 No. 11

Curriculum Revision Based on Social Needs

L. T. Hopkins and F. L. Whitney, Curriculum Revision Specialists, Denver, Colo.

PRACTICAL arts work in the public schools has gone through three stages of development. In the early days it was introduced by schoolmen on the ground of formal discipline; later its retention and spread was encouraged by laymen on the ground of its vocational values and, during the past half dozen years, it has been strongly advocated because of its contribution to vocational choices and guidance.

The first problem confronting any one who is interested in making or revising a practical-arts curriculum is to determine the objectives of such a curriculum. The practical-arts committees, who have been working upon the problem of remaking courses of study for Denver, agreed upon the following objectives for the work.[1] They are given in the order of importance in the opinion of manual arts instructors in the Denver school system.

Rank Order of Manual Arts Objectives

Item	Senior High School	Junior High School
General training for general educational purposes	1	1
Industrial information for informational values only rather than for skills	2	3
Preliminary vocational training for training in some specific vocation	3	4
Vocational training for a specific life activity	4	6
Appreciation of manual labor resulting in an appreciation of the value of labor and respect for those who work with their hands	5	4
Exploratory activities which furnish opportunity for the boy to experiment and test his abilities along different lines of work	6	2

The next problem is to determine just what courses shall be offered, in what years, and with what content in order that the objectives may be reached. There are two methods of attacking this. One is to analyze the objectives into specific attitudes, abilities, skills, and habits which were needed in order to reach these. Such a procedure might mean a long list of abilities entirely apart from the every day experiences of the pupils who are to be taught. The other is to take a comprehensive survey of the practical-arts activities which are being performed in the homes of junior and senior high school boys and girls and which come in the daily life of children or parents. These could then be tabulated according to frequency and organized into courses of study. The aims of practical-arts work would then be met through problems with which pupils are familiar and in the solution of which they can recognize a personal need.

The practical-arts committees decided upon the second method of approach. A questionnaire was organized and sent to the homes of every boy in the junior and senior high schools of the Denver system. This questionnaire contained lists of every practical-arts activity which might be performed by the boys or their parents in the home. These lists were arrived at by having each practical-arts teacher submit all those activities which he thought were being done. These were then checked and added to after interviews with parents. Finally, the lists were brought together and organized under the large headings of painting and paper hanging, plumbing, sheet metal work, bench machine work, woodwork, electrical work, brick and cement work, automobile work, and miscellaneous.

TABLE III

Frequency of home manual arts activities as reported by 3,314 junior and senior high school pupils

		Number of cases	Percentage of cases
1.	Painting (interior and exterior)	1,614	49
2.	Painting porch floors and ceiling	1,570	47
3.	Varnishing furniture	1,527	46
4.	Removing scratches from furniture	1,483	45
5.	Varnishing floors	1,480	45
6.	Using enamel	1,374	42
7.	Painting woodwork and furniture	1,351	41
8.	Removing old paper from wall	1,274	38
9.	Cleaning paper	1,268	38
10.	Painting bicycle	1,219	37

The parents were asked to examine each list and to underscore all the things which needed to be done, or were done by them or their children, in any home in which they had lived. They were asked also to add any items which were not found on the lists given. The number of questionnaires returned with the information asked for was 3314.

Upon tabulation, this information took the form indicated in Table III, only the first ten of the total of 287 items of which are given here.

[1] Stockwell, L. E., General Purposes of Industrial Work for Boys in the Junior High School, Industrial Arts Magazine, February, 1925.

But lists of social activities such as this do not constitute a course of study for the public schools, and in facing the problem of their use in curriculum revision the committees made the following analysis.

Criteria for the Selection of Survey Material for Curricular Use

I. From the viewpoint of the home
   1. Frequency of home activities
   2. Frequency of tool processes
   3. Economic and social status of the home

II. From the industrial viewpoint
   1. Frequency of adult activities in the community

III. From the viewpoint of the school situation
   1. Child ability
   2. School facilities
      a. Housing conditions
      b. Apparatus
      c. Teaching force
      d. Supplies
      e. Time

This analysis cannot be discussed in detail, but it will be noted that it is in accord with modern dicta for curriculum making. It presupposes that education is a continuous process, that it is not only preparation for life but that it *is* life, and that it will aid children to do better things which they will do anyway.

No complete industrial survey of Denver and vicinity was available, but the facts from the viewpoint of "II" above were inferred from data taken from the Fourteenth Census of the United States, Volume IV, 1920.

The economic and social status in the homes of Denver children was determined in connection with an occupational analysis obtained as part of a survey of music activities made by the department of curriculum revision. The facts about the school situation were available in the supervisory and administrative offices of the school system.

The technic of transition from survey facts to course statements will be illustrated, from this point on, by giving the procedure of the junior high school committees in their work on the woodwork section of the junior high school try-out course.

It will be seen that the original data, as illustrated in Table III, consists of lists of home activities engaged in by Denver parents and children. The first problem was to draw off the various tool processes involved in these activities. Table IV, ten of the items of which are given here, shows the number of processes found in 76 per cent of all home activities, frequencies 2004 to 477. The total is 3546.

TABLE IV

Number of different processes involved in each of 207 home manual arts activities

Activity Rank Number (Table III)	Activity	Number of Processes Involved	Rank of Process Complexity (Table VI)
1	Sharpening knives	4	178.5
2	Washing car	5	165
3	Cleaning spark plug	9	127
4	Repairing faucet	10	116.5
5	Gardening	5	165
12	Repairing bicycle	2	202.5
12	Repairing tire (bicycle)	9	127
12	Replacing spoke	6	153.5
12	Truing wheel	2	202.5
12	Repairing chain	4	178.5

When these tool processes are ranked as to frequency they appear as Table V.

TABLE V

Rank order of tool processes involved in 207 home manual arts activities on the basis of frequency

Rank	Process	Frequency
1	Use of pliers	118
2	Scraping	102
3.5	Use of knife	91
3.5	Use of screw driver	91
5	Measuring	74
6.5	Hammering	69
6.5	Use of adjusting wrench	69
8	Use of eye	68
9	Assembling	64
10.5	Cleaning surface	63

Table VI ranks the original home activities on the basis of the number of processes involved in each, and Table VII assigns a key number to each process.

TABLE VI

Rank order of 207 home manual arts activities on the basis of complexity of processes involved

Rank of Process Complexity	Activity	Number of Processes Involved	Activity Rank Number (Tables III and V)
1	Repairing and replacing parts on stool	60	184
2	Making bookcase	58	188
3	Radio construction	52	42
4	Making window box	51	202
5	Making hotbed	50	206.5
6	Adjusting and repairing doors	48	111.5
7.5	Making chair arm and repairs	47	189
7.5	Making screen door	47	178
9	Making various boxes	45	129
10.5	Making a work bench	44	144

TABLE VII

A list of processes involved in 207 home manual arts activities

Number	Process	Number	Process
1	Filing	11	Use of wire brush
2	Shetting	12	Adjusting cap
3	Use of emery wheel	13	Use of gasoline
4	Stropping	14	Replacing plug
5	Use of water	15	Connecting terminals
6	Sponging	16	Removing faucet
7	Removing spots	17	Replacing washer
8	Use of chamois	18	Making a washer
9	Polishing	19	Adjusting of spring
10	Removing spark plug	20	Assembling

The next step in tabulation was to determine for each activity in each of the sections of Table III, just what tool processes were involved. These are referred to in Table VIII by the key numbers assigned in Table VII.

Table VIIIA gives the rank order of these tool processes on the basis of frequency.

TABLE VIIIA

Rank order of processes involved in 33 home painting and paper hanging activities on the basis of frequency in this group

Rank	Process	Frequency
1	Scraping	20
2	Sanding	17
3	Use of knife	15
4	Cleaning surface	12
5.5	Filling	10
5.5	Use of cleaners	10
8	Removing old paint	9
8	Mixing paint	9
8	Brushing paint	9
10	Removing spots	8

At this point, the committee turned their attention specifically to the revision of the woodwork try-out course. They first took thirty items of greatest frequency from the original list of home woodwork activities as indicated in Table XVII.

Turning next to Table XIIA, which gives the rank order of processes in 41 home woodwork activities on the basis of frequency in that group, a list of about 65 tool processes found in these woodwork activities were chosen, those items having a frequency of five or more.

TABLE VIII
Process involved in each of 33 painting and paper hanging activities

Rank	Activity	Number of processes involved (Table VI)	Processes (Table VII)	Frequency number in survey (Table III)	Activity rank (Table III)	Rank of complexity (Table VI)
1	Refinishing furniture	29	7, 9, 26, 27, 52 35, 53, 54, 57, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 83, 84, 86, 87, 97, 100, 103, 105	863	127	39
2	Shellacing floors and woodwork	19	6, 7, 9, 11, 13, 26, 27, 35, 40, 43, 57, 61, 71, 75, 77, 78, 81, 84, 98	596	185	73
3	Painting bicycle	17	70, 71, 74, 75, 76, 77, 78, 79, 80, 81, 84, 86, 137, 138, 146, 152, 172	1,219	56.5	78
4	Painting screens	15	26, 27, 43, 70, 71, 72, 74, 75, 76, 77, 78, 81, 84, 87, 97	1,117	78	84.5
5.5	Filling holes, cracks, knots, etc.	14	43, 51, 52, 53, 54, 55, 71, 72, 77, 78, 82, 84, 85, 100	938	107.5	94

TABLE XVII
Thirty home woodwork activity items of greatest frequency from the original survey (Table III, Section E)

Rank	Activity	Frequency
1	Making a kite	1663
2	Repairing a fence	1629
3	Making a pair of stilts	1262
4	Making a bread board	1228
5	Repairing a screen door	1220
6	Building a bird house	1201
7	Repairing a chair leg	1198
9	Making a pushmobile	1145
10	Fixing loose joints in furniture	1128
11	Putting on new screen	1061

From the list of woodwork activties chosen, eliminations were made of those which were too complex, as indicated in Table VI by the number of processes involved, or if shop and common sense found them to be too difficult. Then, a list of twenty home woodwork activities was made (Table XIX), as a basis for home projects under the management of the school, and a list of seventeen activities (Table XX) as a like basis for school shop projects.

TABLE XIX
Twenty home woodwork activities best adapted to home work by reason of simplicity and convenience (Table III, Section E)

Rank	Activity	Frequency
2	Repairing a fence	1629
5	Repairing a screen door	1220
6	Building a bird house	1201
7	Repairing a chair leg	1198
8	Making a pushmobile	1145
9	Fixing loose joints in furniture	1128
10	Putting on a new screen	1061
11	Repairing a sled	1040
12	Repairing a garage door	998
13	Repairing a chicken house	989

TABLE XX
Seventeen home woodwork activities best adapted to school shop by reason of simplicity and convenience (Table III, Section E)

Rank	Activity	Frequency
1	Making a kite	1663
3	Making a pair of stilts	1262
4	Making a bread board	1228
6	Building a bird house	1201
7	Repairing a chair leg	1198
8	Making a pushmobile	1145
9	Fixing loose joints in furniture	1128
10	Putting on new screen	1061
11	Repairing a sled	1040
14	Making shelves	976

Care was taken that activities chosen should contain desirable processes, and in fact as much common sense was injected into all findings and conclusions as was available from the experience and the general knowledge the committee members had of the entire situation with its requirements.

The primary data of the survey, as it appears in Table III, was tabulated under eight heads, Sections A to H. These were painting and paper hanging, plumbing, sheet metal work, bench machine work, woodwork, electrical work, brick and cement work, and automobile work. In choosing desirable lists of shop and home projects for the remaining parts of the junior high school try-out course, the other seven sections of Table III were used in the manner illustrated for the frequency list of woodwork activities.

The final organization, for the use of teachers and pupils, was in the form of job sheets in sufficient number so that provision could be made for the usual individual differences found in pupil groups.

The attitude of the Department of Curriculum Revision, as its title implies, as definitely stated,[2] and as illustrated in actual practice is that every section of the public school curriculum for Denver must be constantly subject to study and revision. In accordance with this policy, the courses resulting from the work of the manual arts committees to date will be mimeographed or printed as school monographs, and given a thorough trial during the school year 1925-26. In connection with this trial, the work of a committee on achievement tests based on the content of the courses is of great importance. The Department of Classification and Statistics has immediate charge of this committee and of the administration of tests resulting from their activities.

[2]Threlkeld, A. L., Curriculum revision: How a particular city may attack the problem, Elementary School Journal, Vol. XXV, No. 8, April, 1925.

A Course in Shop Processes

R. E. Baker, Head of the Machine Department, Boston Trade School

A FEW years ago, when the writer was endeavoring to "put over" a lesson in shop processes, and the late summer atmosphere was making another urgent appeal to every boy, calling him to go for another swim or on a fishing trip, John Smith blurted out: "Well, what good is that subject, anyway?" Just then a lusty voice floated through the listless air. "Ripe-a-banan, twenty-five a duzz." The originator of this familiar sound was a husky son of the sunny clime, recently arrived, and he was pushing a cart. He evidently knew that he had bananas to sell, that there were twelve of them in a dozen, he could make change, keep to the right, and keep pushing until his load was gone, and then return home and get ready for the morrow's trip.

What cared he whether bananas were minerals or vegetables, grew on trees or like peanuts, came from Alaska or Africa? There was food and shelter at the end of the day, with bananas at twenty-five cents a dozen. But his day did not end when he wheeled his cart into the alley. He wanted to know more of the English language and of the mysteries of arithmetic.

He sauntered down to the wharf one day and watched them unload bananas. They looked different from those which he followed round all day. Oh, yes, they grew on trees in the West Indies, the West Indies were islands in the tropical zone, the fruit was picked green and shipped to Boston and other coastwise cities by boat. Some were put into freight cars for inland cities, and some were sent to storehouses for ripening. These were sold to someone for wholesale prices, a different price from what he paid, and from what he received.

The next year when he called his wares he had a horse and wagon, and melons and lemons were added to his stock. The next year a flivver "purred" over the pavements, and he was selling to stores by the bunch and crate, and now he is starting in a modest wholesale business of his own.

Is this a fairy story?

Secure a place for a 16-year-old boy of ordinary intelligence and good physique in an up-to-date machine shop and in a month to six weeks he could become a fair screw machine operator. If he stayed at that job in that shop, or in other shops for fifty years, he could most certainly make a "living." Would he need mathematics? No. Drawing? No. Shop Processes? No. "Well, what good is this subject, anyhow?"

The course in shop processes as conducted in our machine department is to help acquaint boys more quickly and more thoroughly with the principal machines and processes, to stimulate interest in the larger aspects of the trade, and to show the relation and interdependence between this and other trades. Its primary aim is to teach boys to think, to enlarge their trade vision, to show them the progressive relations of skill of hand and brain, and the opportunities which will open up and offer themselves to boys who have habits of industry and honesty, and an ever-enlarging interest in their work. It is one of the subjects which lies between the machine operator and the first-class mechanic or shop executive.

The course is laid out in four units, one for each school year. It is conducted two periods a week in the classroom with the aid of machine photos, blue print diagrams, models, and blackboard sketches. In common with the other "related" subjects it is built around the "shop" course.

This "shop" course has been laid out in progressive operations upon the principal types of machine tools, bench work, and simple tool making. In each year's work is included the processes which the shop instructors feel might very probably be included in the training of an apprentice in a commercial shop. The order of machine training is somewhat different from that followed in commercial shops for they must think of production principles; a trade school should think of education principles.

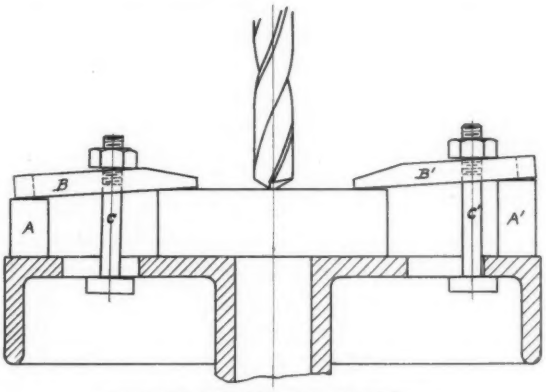
Under the existing conditions of the shop equipment and the products which we machine, the course cannot be followed arbitrarily or consecutively, but it furnishes an outline of progressive steps; during a school year each student must have satisfactorily completed the processes to be promoted. A boy may be obliged to take up work upon the shaper before he does the scheduled drill-press work, but we endeavor to follow each machine group of operations as closely as is possible. The outline is the one followed by the larger number of boys at a given time in the year.

The shop processes course aims to correlate with the shop outline: to discuss thread cutting when the largest number of boys are getting thread-cutting practice in the shop, or taper turning when most of them are turning tapers; but it is quite obvious that when 24 boys are working upon lathes, three boys may be working upon simple milling machine jobs, three upon shaper work, two at the drill presses, and five at the bench. The lathe discussion will have deferred values for some, but each boy will be urged to observe lathe set-ups and jobs, and enter freely into discussion. Of course, the boys working upon other machines will have received personal instruction for their work in the shop, and when the time comes for discussing the drill press or shaper, some boys are ready with reliable and helpful information.

Let us consider briefly in this article the outline for the first-year course.

During the first weeks when newcomers are cleaning up machines and tools, working at the bench, or observing the older boys at their machine work, the shop processes lessons are upon some of the general phases of shop work, about the new conditions in which a boy finds himself.

"Safety First," is emphasized first, and all the time. Rapidly moving belts, pulleys, and gears must be treated with respect, and never handled without instructions from the teacher in charge. The machines, tools, and materials with which a boy is working must be considered by each one as his personal property, and treated as such. The obvious "why's" are discussed and the importance of right habits at the start is emphasized. What are some of the comparisons between the "manual training" shop and the machine shop? (Generally the manual training work is the only shop experience which

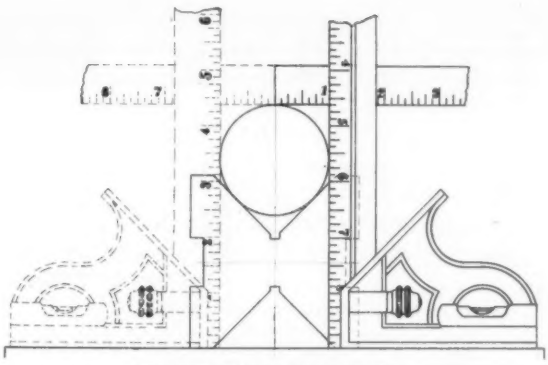


SUGGEST CORRECTIONS IN SET-UP.

our boys have had.) What are some of the outstanding differences between the tools used in one shop and in another? What are the principal differences in the materials worked upon? These and similar questions arouse the interest and furnish the connecting link between the known and the untried shop activities.

The important principles of cleanliness, of accuracy, and of the proper oiling and care of machines and tools are iterated and reiterated. The writer does not think that this can be over-emphasized. A tiny speck of dirt in one's eye will spoil an otherwise good day's work; a nail sticking up on the inside of a shoe will spoil a good walk. Dirt in a machine vise or chuck, burrs left by lathe or shaper tools, or taps and dies, will most certainly contribute to poor and inefficient results. To be sure, some shop jobs do not require as much care and accuracy as others, but we try to teach the best workmanship.

Next in order comes classroom instruction on the most commonly used tools: 6″ steel scale, combination square, outside and inside calipers, hammer, monkey-wrench, screw driver, hack saws and files. With these tools, and materials from the shop, the correct uses of each are illustrated. The wrench supplied with our lathe tool holders is about 4″ long; it tightens up on a $\frac{5}{16}$″ square head set screw. It will not require much

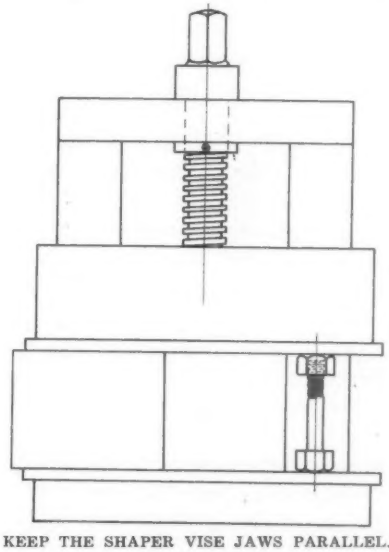


CENTER WORK CORRECTLY.

skill to show the danger in using an 18″ monkey wrench on a tool-holder set screw. The correct methods of setting to scale size, and of measuring stock with outside calipers are graphically shown.

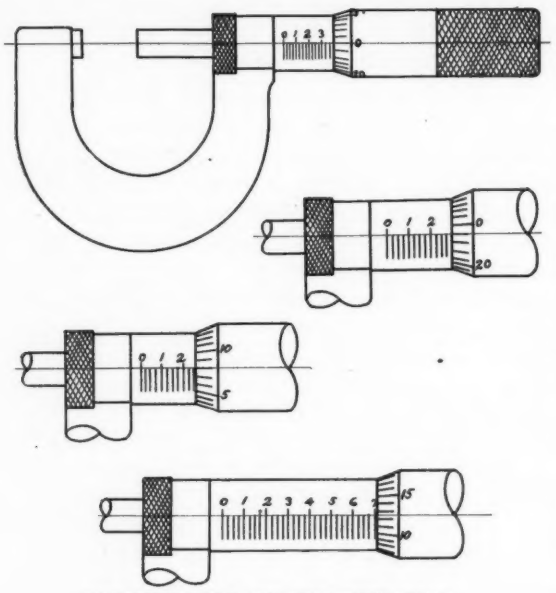
To be sure, the students get this instruction in the shop, but we feel that it is very much worth while to emphasize it in classroom discussion also. It will stimulate better interest; it will point out good reasons to the thinking boy; it will reach every one in the class, and it will help emphasize the idea of "thinking" on the job.

The first machine to be studied is the engine lathe, and the method of approach is to name, state the position, and tell of the general use or uses of each principal part. An attempt is made to have students name, in order, parts which are closely related to each other. In later experience, when blue prints and materials are handed out, it will make considerable difference whether the workman goes at his job in proper sequence of



KEEP THE SHAPER VISE JAWS PARALLEL.

operations, or in a haphazard way. It will be very obvious to readers that shop instruction will be more efficiently carried on if the boys have a speaking acquaintance with the machine upon which they are getting instruction.



HOW THEY LOOK AND HOW THEY READ.

In a brief and general survey, the principal operations on a lathe as side facing, straight turning, taper turning, thread cutting, and boring are considered. Then, with more detail, each operation is studied. The proper length for cutting stock, the methods of centering, the "how" to drive, squaring up the ends to proper length, recentering if necessary, the roughing cuts, the finishing cuts, the squaring of shoulders; all these are questioned and information given. The proper speeds and feeds, the tools to use, the set-ups and methods, and the measurement check-ups to accomplish good work in straight turning are considered. Although many of the boys will not be doing work which warrants the use of precision instruments, for the sake of those who are doing such work, and as a stimulus to more care and accuracy, we shall take up briefly the construction and uses of one inch outside micrometers.

Does the classroom teacher ever speak of methods of doing a job, and the shop instructor give different directions for similar work? Oh, yes, that quite often happens, and quite often boys will apprise the teacher and the class that such differences exist. They are bound to exist in detail but not in the main; there may be some slight differences as between shop instructors, due to the differences in conditions of equipment or materials. In every instance, however, we explain that all are in accord with the principles involved, and we make it very emphatic that boys take their shop orders and follow instructions from their shop instructor.

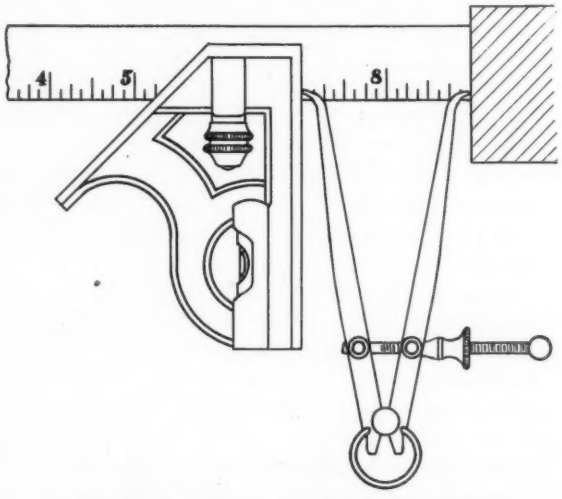
We have now arrived, in our shop and classroom work, at the end of our second month. Let us check up. Bi-monthly examinations, of two class periods' duration, are conducted throughout the year. Machines, tools, and methods considered in classroom discussions are questioned. These serve as a check-up to the classroom teacher, and indicate to him how his lessons are being received. "But how about the application of the classroom work to the boys' actual shop practice?" you ask. "And how about the boys who are doing shop work different from that discussed?"

On alternate months a shop report is written by each boy. These reports consist of a written article on some recent shop jobs, stating the name of the project, the materials, the approximate dimensions, the machines, tools, and set-ups, and the methods of laying out, carrying forward, and completing the project. Each report is carefully examined and marked, and one or two class periods given to the discussion of different papers. Keen interest is apparent in these discussions, and the writer can attest to the marked improvement shown in subsequent reports, and the added interest shown in tackling a shop project.

After the first examination paper, we resume our study of the lathe, giving a few lessons on taper turning. The three methods employed are briefly outlined, but more time is given to the off-set, tail-stock method, and the swivel of the compound rest. Diagrams explain more clearly the relation of length of stock and amount of offset. Diagrams of compound rests will more clearly show the importance of starting on a taper problem with the rest in a line parallel with the axis of the lathe.

Next is a general study of screw threads and thread cutting, to familiarize the class with the terms used, and ordinary uses of V., U. S. S., S. A. E., square, and acme threads. The reading of thread cutting plates, the proper adjustments of change gears, the proper setting up of tools and the methods for roughing, finishing and sizing the most commonly used V and standard threads are then discussed more in detail. One lesson is used for the speed lathe and its ordinary uses, and this completes for the present our lathe study.

We now devote a few lessons to bench work; simple laying out, chipping, filing, hand hack sawing, hand tapping, etc. What is the most frequent cause of saw blades breaking? Why do hand taps break? Are there



A SUGGESTED USE FOR A COMBINATION SQUARE.

generally poor results other than tool breakage, when these tools do break? How may you avoid broken tools and poor results on work? Some boys will be willing to make answer to these questions from their own shop experiences, and help to teach the desired lessons. It is one of the aims of this course to encourage boys to speak of their shop experiences for the mutual help of others working on similar jobs.

The drill presses, upright and sensitive, next take up our attention. We first get acquainted with the names of the parts and the general work done upon them, and then study the detailed set-ups and methods of using. Great stress is laid upon the principle of having the tools and work rigidly held. You all may have experienced a "merry-go-round," with work, wrenches, packing blocks, straps, and oil can trying to get to the floor first, and possibly a bad cut when the operator grabs the work before shutting off the power. We try to avoid "merry-go-rounds."

A front view diagram of a drill table is sketched upon the blackboard. Upon it is sketched a rectangular block set up ready for drilling. The washers are lacking between the hexagon nuts and the U straps, one packing block is too high, another is too low, one bolt is nearer the packing block than the work, another is tightened up out of square with the table. On this diagram we number or letter the tools and appliances used, and then start a discussion, asking for suggested changes. From our experience we most certainly believe that this sort of discussion pays. Of course the next day we may see in the shop a glaring example of "what not to do," but we have a talking point at least, and we feel that such mistakes are greatly minimized. Cylindrical work to be drilled, held in a vise, give splendid opportunity to show how to set the work up central, how to prevent a sagging of the work, and the proper method of starting the hole on this particular shape of surface.

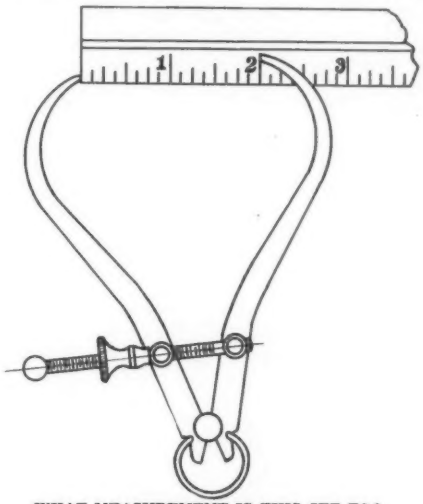
The next machine, the shaper, introduces a new principle: the straight line stroke and the resultant plane surfaces. But someone may wish to interrupt here and ask: "Do you follow your outlined lessons closely?" Our answer is: "As closely as we think is consistent with good teaching." Smith has been working in the tool crib, and has wondered what that fellow is doing in the tool room, who is using the relieving attachment on the Hendey. Smith asks about it in class and very properly in a brief way we answer it. If an accident has occurred because of a faulty set-up or other carelessness, draw a lesson from it. If exceptionally good shop work has been done by some boy, a word of commendation generally has good results.

But to get back to the shaper. The principal parts and mechanisms of the machine are different from those previously studied, and our lesson of acquaintance may very profitably be conducted by asking questions of comparison. What part of a shaper is somewhat similar to the compound rest on a lathe? Wherein are these parts different, and why? By what method do we get the quick return stroke on a geared shaper, and on a crank shaper? These are just a few suggestive questions outlined in our course.

We next discuss the best methods of setting up and planing a rectangular block to square up the faces and sides, and we try to show the "why" of these methods. Splendid illustrations can be used to show that a three-point bearing is generally preferable to four points, especially on rough castings.

Diagrams can be used to show how to tighten up the vise jaws parallel when squaring an end, if the work held is too short; or how to keep the work from sagging for the same operation. The first year's shaper work consists mostly of planing rectangular blocks with tongues, grooves, and angle surfaces, and the work depends on the shaper vise for most set-ups.

The last type of machine for the first year's consideration is the milling machine. Here is a combination of some features of the lathe and some of the shaper, and the comparative method may be efficiently used in a discussion of the principal parts and the general work performed on them. A new type of cutting tool may be used, with several lessons devoted to the study of shapes, sizes, methods of driving, directions of cuts, and their ordinary uses. A review of shaper-vise methods of holding work acquaints students with quite a wide range of first-year milling machine set-ups.



WHAT MEASUREMENT IS THIS SET TO?

But the index, head-and-foot stock, and work held between centers bring up new problems. The mechanism and uses of the index head are explained and the class becomes familiar with such terms as: index plates, crank pin, sectors, circles, and ratios. Direct and indirect indexing are studied, and problems worked out to show how to read the machine charts intelligently for simple operation.

We have now completed the cycle of machines studied and worked upon during the first year, but we continue with a few more lessons on the start of the second term or cycle, namely the lathe, as it applies

to chucking, drilling and boring in a chuck. We first consider the universal three-jaw chuck, and the types of work for which it should be used; next the four-jaw independent chuck. Emphasis is placed upon the proper method to use to mount and take off chucks on the lathe spindle, how to get castings ready for the chuck, how to tighten up, which surface to true up first, which second, and how to set up on the jaw screws to hold work with uniform strain.

For solid work which must be drilled first for boring out, study the proper method of centering the stock, the proper size drills to use, the methods for using a drill holder, the objections to using the tail stock spindle to hold the drill, and the special precautions to take when starting the drill, and when the drill is breaking through. For boring holes, either drilled or cored, we discuss the proper tools to use, the correct setting up of the tools, and the special care necessary to offset the results of tool spring.

This, in brief, is the outline and the method of presentation of the shop processes course. The actual course contains outlines for 41 lessons. These are not assigned one lesson for each period of class recitation, but are merely the divisions of the subject matter which seem most practical to follow. The year's work is general in its scope, therefore it must of necessity cover very briefly subjects which later demand more time; but we feel that the first year's work should be more one of "doing" in the shop, and of getting acquainted with the "language and customs" in the classroom.

The Overtimers

S. G. Johndroe, Evening Registrar, Wentworth Institute, Boston, Mass.

WE have heard and often read that the apprenticeship system has disappeared, and it has usually been mourned with appropriate obsequies. If any system or means of education passes away under our form of government, and with our ideas of the individual, it is because that kind of education has outlived its usefulness. It has gone because it could not "sell" itself to the individual on its merits and was so forced to the point of starvation. The apprenticeship system has gone because it did not fit our ideas of either a proper individual development or of a reasonable time in which to make that development a producing force for the individual making the effort. Naturally it disappeared, probably never to return. And before it departed, the force which drove it out had developed and become strong enough to take its place.

And what was this force? It was the force of a more or less organized system of vocational education. This system was successful because it cut the time and the expense of learning a trade, into a fraction of what it was under the apprenticeship system, and at the same time it "sold" itself to many thousands of individuals who had never before thought of learning a trade. Located as they were in the industrial centers of our large cities, vocational schools developed courses planned for very specific ends and became, justly, exceedingly well patronized. This is but the beginning. The kind of education devoted to very definite ends and those ends chiefly economic, is bound to reach very much greater proportions.

One direction in which this movement has gone, has been the evening school. Practically all over our land, in all of its many cities and in more and more of its villages, and country districts through the fall and winter months, the older students are gathering and learning how to do the things necessary for their living. Courses are given in practically all of the bread-and-butter subjects of daily life. To be a success a course must "function," that is, it must have a purpose easily seen and recognized by the student as one with his purpose. If it does not function, why waste the pupil's time? The apprenticeship system often failed to function. Its advocates failed to recognize the changes that had taken place in industry. Time had become a very important factor because populations and their buying power had greatly increased. It had become necessary for young men to get into production as soon as possible, because high wages and markets were calling for goods. The evening schools had enabled men to continue in production and to grow in skill and knowledge attainment at the same time. High wages demand this condition and they are one of the most potent forces in society.

We state emphatically, then, that the courses in an evening school must function directly and immediately in the individual's life. If they do not do this, they will certainly be discarded and before being discarded they will drive out many students. Our educational attics will soon be pretty well filled with educational furniture which was perfectly good in its day, but which at present fails to satisfy.

What of our evening school students? These consist of the skilled or semi-skilled workmen of our industries, and the men and women who possess ambition and initiative. These come in of their own volition. No apprenticeship contract is needed to drive them. They come though they are ill enough to be at home, and with reluctance give up the school for the sick bed or for overtime work on occasion. The pleasure of an evening at home with the family is exchanged for two hours more of work with a purpose, even after a day of toil in the shop or at the desk. This they do three or four evenings a week during six or seven months of the year. And they often do it year after year until they have reached the desired skill or knowledge which they have usually carefully planned for. They have seen the job ahead and have prepared for it. Naturally they

very often get it. The only requirement has usually been their ability to do it well. How different is this idea from that of a prescribed number of years of apprenticeship! As if man's power of accomplishment could ever be measured in terms of time. We are becoming more democratic as the years go by, and our educational system must be quite as democratic as our other institutions. Do the job and you may have it, is industry's requirement.

Of course, the main idea of a real trade school is "good workmanship." The statement made so often in the press, that we have no "workmanship" such as existed during the period of the apprenticeship system is in a sense true. But it is only partly true, which makes it all the more fallacious. We really have more good workmanship in the world today than in any known period of history. Workmanship, like anything else, can be bought. Anyone who desires workmanship at the present time can easily find it, if he wishes to pay the price. The fallacy in arguing the question of workmanship usually arises in that we illustrate it by comparing an aristocratic article of long ago made by good workmen, with a machine made article of today, often produced by a mere machine operator who is not a workman at all.

Evening school students become good workmen because of their shop experience and because of the skill of their instructors at the school. The shop instructors of the evening school must be skilful workmen if they are to retain their pupils. And with this skill they must have industrial experience that they may be fitted to advise their students. It is often very difficult to find good workmen in industry who are good teachers and to pay them enough to interest them. This must be done for all of the shops and drawing rooms.

To secure good workmanship more is necessary in a shop than a good teacher. There must be good tools and good industrial equipment. This last must not be trick equipment, but it should be of the most prevalent industrial type. It should be fitted to do "real jobs."

The successful kind of evening school work requires the doing of something real on the part of the student. The school must make him feel that he is accomplishing something worth while and of actual commercial value. He will, at the same time, feel that he has gained a slight hold on the job ahead. Promotion or a raise in pay often comes along soon after and then he is a regular "overtimer." He wouldn't miss evening school for anything because it has tied itself up with his bread and butter.

The "overtimer" demands courses that are one with his purpose and those that function directly in accomplishing that purpose. This can, of course, be done only by means of "real jobs." The selection of those courses is of the greatest importance. A very complete survey of the cities' industries should be made before the courses are decided upon. In truth, it may be necessary to extend such a survey to a radius of twenty miles, since the evening school enrollment is very probably to come from the area of such a circle. It is surprising how far men will go to get just the kind of vocational training they need on the job. We have in mind one man who came 45 miles three evenings a week for three years to get such training. He was then a molder and working nine hours a day in a foundry. He ate his lunch in his overalls on the trolley and was at school ready to begin work at seven-thirty in the evening. He worked until half past nine and reached home shortly before twelve, midnight. He is now superintendent of his foundry. Evening school helped him to do it but it did not do anywhere near all of it. The kind of character he showed in thinking up the school scheme, and in putting it through, did a great deal more toward making him superintendent than did anything else.

Evening school men, in the majority of cases, know what they are after and where it will lead them. A 17-year-old-boy came into the evening school office three years ago. He said he wanted to be a carpenter and stuck to his statement. He was told to go out and get a job as a carpenter's helper and then we could help him. He came in the next week with a letter from his employer stating that he had the job, and he was placed in the class. He finished the term with the other men, a period of three months, and was advised to come back the next year and get all the work he could. He did so, and advanced so well that he was soon assisting the instructor as foreman of a group of men much older than himself and with far more experience in years at the job. He was advised to take architectural drawing the next year, and did so. He learned to make blue-prints and, of course, to read them. He now has his union card, is employed on inside finish, and his employer says he's the best man in the crew. The union card means little or much, but his employer's good word means a lot. This boy is now a regular "overtimer" and he's on his way. He knows where he's going too.

Evening school men are as direct in their desires as they wish the course to be in its method and content. They cannot be "bluffed" or put off with appearance instead of reality, with talk about doing things in place of the action itself. They are interested from the start, and with half a chance will get something worth while from their instructor, provided he has something to give them. If he hasn't anything at the time, it behooves him to get very, very busy to hold his men.

The interest of the "overtimers" in a course is immediately reflected in the attendance report. In fact, that report through a series of years will be the best possible measure of the success or failure of an evening school. Two or three evenings in succession of "nothing doing" on the part of the instructor will tell a terrible story when the attendance record is plotted. The efficiency of the teacher can be pretty well gauged by the interest his students feel, as shown by their attend-

ance. This is usually, or should be close to ninety per cent of the enrollment. Many evening schools do not reach this percentage of attendance, but we think they should. Many times the cause is obvious to anyone looking into the classroom about fifteen minutes after the class has gathered. By that time things should have begun happening in earnest. Every man should have a job and be doing it.

Very few evening school classes can survive a long period of lectures unless they are given by a very remarkable instructor. They can endure any amount of individual work based upon particular jobs that fit in with their own individual purposes. The project method is ideal for practically all evening school trade instruction, but not projects arranged in a rigid, logical order. Everything given an evening school student must be given not to *repeat* but to *supplement* the individual's experience. What use could a man, who had run a lathe for five years in a job shop, find for any school's "lathe exercises?" That man wants work on the "miller" and he's going to be a dead loss if he doesn't get it.

And the man is right! Logically organized courses having one specific aim have no place in the evening school. There are too many different individual purposes represented in the class. In the drawing room, for example, there are several different purposes represented. We find machinists there who want tool design, electrical men who want switch board design, sheet metal workers who must learn how to lay out cornices, piping, etc. Some are from the forge shop who must learn to draw ornamental iron work. In fact, we shall find them from all industries in which machine or metal trade blue prints are used. And all these men must be given the kind of work that they came to get. If they don't get it, you'll have to look around for other students to keep your plant running at nearly its capacity. They want nothing, however, but what an experienced mechanical draftsman can give them if he cares to arrange and plan his work carefully and is given time to do so.

No amount of academic training can take the place of industrial experience for a trade school teacher. This is particularly true in the evening school work. A college degree will mean very little indeed save to indicate that the man is capable of digesting and using well a lot of experience. He must have attained some of that trade and industrial experience before he can understand either the trade or the men in it. The days when a college degree meant anything really definite in a knowledge of things have long since passed. The worst thing about the attitude of the average recent academic college graduate in a trade school is his apparent contempt for the whole thing. To him standards of a purely theoretical kind are everything. It is very often a more skilful operation to cut a shaft accurate to "0001" than it is to figure out all the facts concerning that shaft accurate to the same degree.

In brief, the function of the trade school and its evening school is to help men and not to maintain any academic standards whatsoever. We forget all standards save that of good workmanship and strive always to help the man. So long as the student is industrious and shows improvement and interest, he may remain. To drive a problem out of a school the back way is not to solve it! The greatest service any institution can do for society is to save its boys. The evening school can do this even better than can the other institutions of the community.

The total loss of an evening school even in this New England climate should not be more than thirty per cent. In fact, we have cut that percentage a bit several times and if we were to subtract those students who left for illness, or for very pressing economic reasons, such as unemployment, changes of residence, etc., we have very seldom had a loss of over fifteen per cent. The "overtimers" have a good reason for dropping their evening school work.

This small loss has been due mainly to the courses selected, to the teacher's skill in presenting those courses, to the wonderful equipment for giving "real jobs," and to that spirit of cooperation between teachers and students which soon becomes the most important single thing in developing an evening school.

An evening school teacher must study his pupils, and their needs and abilities, more than he studies the subject he is teaching. He should know that well enough anyway, but to know his men is of the greatest importance in that it leads to a personal bond which should endure to the advantage of both man and school. He must study them to such an extent that he knows all about their jobs and their personal qualities that enable them to fill them. He should know their economic situations and their ambitions. He should be a friend to them in every possible way. These men will meet him half way and having won them to himself by a real interest in their welfare shown by his work and thought for them, he won't have to worry about attendance.

Knowing all these things about the man and having had experience in industry and from that knowing a good deal about jobs and their requirements, he should be able to guide men wisely in their choice of positions. Not that there are "blind alley jobs." The thing is that there are many blind alley men. Any job would be of that kind if they attempted to fill it. In any job, either the job develops the man, or the man develops the job. When neither process takes place, we have a "blind alley man." Such men do not remain long in an evening school. That becomes merely another "blind alley" to them. They frequently change positions several times a year and in changing positions frequently change their trade entirely and so scrap all their limited experience in it and reach the age of 25 or 30 with no trade whatever and, of course, with no particular skill. All worthwhile jobs have to be won by ability to do them well and

that usually means a rather long experiential period of low wages. These men haven't the patience to go through with it. They make up in large measure the evening school turnover.

It is a very difficult matter to reduce this turnover in that it comes from a cause in which the school is not at fault, and therefore cannot alter. The best means for so doing is that of wise vocational guidance by the instructor. If he has gained the confidence of his pupils to such an extent that they tell him of themselves, he can comment freely on their mistakes and advise as to their future activities. If the school has an employment bureau, which all vocational schools should possess, either managed by a mature instructor or by a man experienced in such work, this advice can be carried out even to the point of changing positions advantageously. After this is done and the student finds that the job pleases him, his loyalty is probably secured and he is much easier to advise. He can even be kept in the school for several years, perhaps until he becomes a good workman.

A successful evening school should retain from one-third to one-half of its enrollment from year to year. If it does this, it can be pretty sure that its students feel that its courses function in their lives. One advantage of retaining these men is that they are faithful in attendance, and they are pretty well known to the instructors. They do not then require so much of the teacher's attention at the start, allowing him to work with the new men and really satisfy them.

The means of retaining such a portion of the enrollment are various and every legitimate means should be used, remembering that service to the man is the main thing. If the instructor really feels that the school can be of further use to the man, he should be urged to remain. If the school has no course that fits his needs, he should be urged to leave and go where he can obtain it. An opportunity should be given men to visit other classes in the evening school than the one in which they are first placed. This should be encouraged and if rightly managed will cause no confusion whatever. It is not propaganda, but simply the policy of letting customers look over the goods thoroughly before purchasing. Before any man is accepted, he should be made to express in writing the definite purpose for which he wishes to use a course. This gives a basis for the instructor's advice and so the educational and vocational guidance of the school can be started at once. We have found this to be of the greatest value to the men and to the school, preventing loss of time and effort for both. Since we have applications several times as numerous as any class can accommodate, we feel that we should pick those men to whom we can be of the greatest service.

The courses which we have found to function best in the lives of industrial workers in this part of New England are as follows:

Building Trades
Architectural Drawing and Design
Structural Design
Building Construction
Carpentry and Building
Plumbing
Electric Wiring

Metal Trades
Mechanical Drawing and Design
Pattern Making
Foundry Practice
Foundry Chemistry
Metallography
Machine Work
Tool Making
Forging
Acetylene Welding

Printing Trades
Composition
Presswork
Photo Engraving

Electrical Trades
Applied Electricity
Direct Current Machinery
Alternating Current Machinery

Steam Power Plant Operation
Practical Mathematics

In these courses, we have striven to select only those in whose content there was at least a good, effective year's work. We feel that to take in men for less time would be unjust to the school. With these courses we have found that the great majority of our men remain two years. Many remain three years. We know a few men who have attended six years, and two who have attended seven years.

With the present immigration law in force, we have found an improvement in our applicants in that they can speak English well and they read with greater facility than was the case a few years ago. They are becoming Americanized to such an extent that they accept our advice. Formerly they seemed to think themselves discriminated against, because we always insisted upon a plan for their development and that they obtain a job that would be in keeping with that plan. Now they take it all as a matter of course and have in consequence become much better workmen than was previously the case.

We find, of course, that an improvement in men makes an improvement in everything else about the school. The attendance record is the first thing to react. If good men can be picked for the class, the attendance will follow. The waiting list, which we have in nearly all classes, is a constant reminder to the men that their places can and will be filled promptly if they do not fill them. The more noise we make about attendance, the more careful we are in checking it up, the more prompt we are in dropping men who fail to show up a few evenings without giving an excuse, the better our attendance becomes and the fewer men we lose. When we first started out to obtain good attendance by this means, we were told that we couldn't treat evening school men in such a way and keep them. The contrary is true. They appreciate good businesslike treatment and react favorably.

To summarize briefly we have concluded that the following are absolutely essential to good evening school work and naturally to good attendance and consequent small loss:

1. Courses that function directly in the lives of men in industry.
2. Instructors of skill in all classrooms and shops.
3. A personal bond between instructors and their students.
4. A good industrial equipment.
5. Real jobs and good workmanship.

6. A large number of projects fitted to a large number of individual purposes.

7. The constant effort to serve men in every way possible.

8. An insistence upon and a careful checking up of attendance.

9. Developing the idea that the student owes to the school his very best effort in every way and making him give it.

All these things, if made the working creed of an evening school, cannot but make it successful and sought by men who wish to progress in their daily work. Apply these principles in dealing with the "overtimers" and they'll come and thank you for it. They will also give you the most effective kind of advertising in that it will be entirely voluntary and enthusiastic. You must expect that there will be a few dissenting voices. They will be very weak, however, in view of the fact that they were dismissed for non-attendance or for lack of industry. Those are the only reasons we have used to get rid of undesirables. These have not been numerous owing to the very careful interviews by means of which we have selected the men. These are based on the following questionnaire:

Name .....Date.....192....
Address No.....Street Age.....years
City or Town..... State.....
1. What Evening course do you wish to enter?.....
2. Have you previously been a member of Wentworth Day or Evening School?.....
In what course?.....Year.....
3. Did you complete a Grammar School Course or one of equal grade?.....Where?.....
4. How many years did you spend in High School or School of equal grade?.....Did you graduate?.....
If so, was the course Scientific or Technical?.....
5. How many terms have you spent in Evening Schools? ..... Where?.....
What year?..... What subjects did you cover?.....
6. Describe carefully your regular employment.....
7. How long have you been employed at this work?....
8. Have you a definite purpose in taking this course?... What is it?.....
9. Will you agree to attend regularly and complete your course if you are given a place in the class?.....
10. Give name of person knowing you well who can vouch for your reliability and character.....
Name .....Address No.....Street.....
City or Town.....State.....

The back of the above contains the following paragraph which is especially called to the attention of every applicant:

Applicants Are Requested to Read the Following Regulations:

Regular attendance at every exercise, faithfulness, earnest work, manly conduct, and willingness to cooperate at all times with the instructors and officers of the Institute are expected of every student; and anyone who fails to meet these requirements will be asked to withdraw from Wentworth Institute.

Tuition is payable in advance.

RECORD OF STUDENT:

Interview Notice Sent.....
Acknowledged.....
Course.....Year.....

Before the student is accepted, he knows what to expect and he signs a contract to keep the agreement. We live up to our part of the contract and very soon tell the student if we feel that he is not living up to his. We have never had to dismiss more than ten students in any one year for lack of cooperation. They didn't want to pay the price for good workmanship in effort and patience. Patience is the stumbling block. Our youth are in such a hurry! They cannot wait to work out a sum of money, they must take a gun and "hold up" the public. To hold them up for a job poorly done, as some workmen are seemingly glad to do, is not so different.

We must cultivate in our workmen a feeling of their responsibility to society for a good job. Our evening schools can do a great deal to remedy this. Many of them are doing it, but there are others that have such short courses that the thing cannot be done, because students are not kept long enough to form either satisfactory habits or modes of thought. Short courses usually require so much of constant advertising that they are very expensive to keep filled. They cannot possibly result in good workmanship because an entirely insufficient time is given to practice. The lecture and discussion method used in many of them would be fairly good in very carefully selected class of well educated men, but for the men they take in, this method becomes an excuse for doing very little study. As an entertainment it is good! As education, its value is questionable! The main reason for this last statement is that it is likely to develop a bad set of habits.

How can we develop the habit of good attendance? We have used the following ways successfully we believe, but we are always open to suggestion.

1. Impress upon all applicants at the beginning of school and throughout the term that they will be dropped if they are absent three consecutive evenings without an excuse.

2. Accept no excuses, save illness and overtime work. This last only if it could not be avoided.

3. Promptly fill all places left vacant by an enforcement of No. 1 if the waiting lists permit. We are very fortunate in that these are usually long.

4. Write all who have been absent once or twice by means of a return postal card properly worded to obtain their excuses, and convey a warning as well as a cordial wish for their prompt return.

5. Make the final reward, be it certificate, diploma, or letter of promotion, dependent somewhat upon attendance. Notify all men, at the beginning of the year, of this condition.

These provisions will rid most schools of most of the undesirables during the first two months of the school term and attendance work will lessen to such an extent that instructors can give attention to the rest of the evening school. All the clerical work can be done by a boy who can write well and run a typewriter, but he will

have to be supervised carefully. And the instructors must be requested to emphasize attendance frequently, and to urge men who are out now and then to make a desperate effort to cut down their loss of time. Having these men report at the office immediately after an absence often does them a world of good. They realize then that they are being checked up by several different men and that the school takes the matter seriously. If they like their school work, they hesitate at doing anything that will deprive them of their class privileges.

The Four-Stroke Cycle Illustrated and Explained

Ray F. Kuns, Cincinnati, Ohio

THE engine-and-ignition instruction stand is the result of some years of active instruction of automobile apprentices and mechanics. A number of instructors have given their best efforts to produce an instruction stand having all the essential characteristics of an engine, and yet leaving the model in such skeleton form that its operation and functioning of parts could be easily understood. If the model itself could be placed in the hands of a learner for a period of sixty minutes, it would clear up in his mind many things which are likely to be hazy. Since this is manifestly impossible, the next best thing was to make a series of pictures which show the critical points of the *four-stroke cycle* and gives an idea of the relation of vital parts at each point. The view presented in Figure 5 is one of the rear of the model and corresponds to a view of any four-stroke engine from the rear. It will be noted that this model carries a crank shaft, a cam shaft, and an ignition-drive shaft. The crank shaft has but one throw which is all that is necessary as a rule in timing engines or ignition. Likewise, but two cams with the two valve lifters and two valves, are shown in their approximate relation with the single dummy cylinder and piston, and the one connecting rod.

While only the first cylinder of an engine with its related parts is used in engine timing, when it comes to ignition timing, firing orders as well as the firing point for the first cylinder must be considered; for this reason eight plugs are shown as for a modern eight in line engine. A coil is provided as are also a switch ammeter and wires, for connection to the storage battery, so that the spark as developed and directed to the plugs, may be observed and the correctness of the work tested. Gears provided are such as to drive the parts in exact time and relation to each other. The cams are exact, and the valve action is correct both in lift and in degrees of crank shaft travel. This in so far as any selected standard corresponds with the numbers of engines on the market which may vary from the one selected by a few degrees either way.

The student needs to visualize in its entirety the carburetor and the manifold, which supplies the gas to the upper end of the cylinder and the exhaust manifold, which allows the burned gases to be driven off through it to the muffler. The installing of these parts makes the model a bit cumbersome, as well as hiding the action of valves and other parts. As it is, it will be noted that the valve heads are visible, and their relative positions for the different strokes may be observed. If a student can grasp the fact that any cylinder of any four-stroke cycle engine is fired but once for each two revolutions of the flywheel and the crankshaft, he is in a position to grasp the complete principle in a short time.

Understanding that the cylinder is fired once for each two revolutions, means that it is understood that any mark we may make on the flywheel will travel 720 degrees for each explosion. The number of cylinders has nothing to do with the theory. What is true of one cylinder is true of each and every cylinder in the engine. Each has its own crankshaft throw, pair of cams, pair of valve lifters, pair of valves and related parts. We are speaking now of engine timing; ignition timing will be explained later. They are separate items. When the engine timing is correct, the ignition timing is easily secured. So, then, in studying engine timing, have in mind only the first cylinder and its related parts.

There are 360 degrees in a circle and since the engine flywheel is of that design, there are, then, 360 degrees in its surface. If it turns twice for each explosion, then it travels 2 x 360 or 720 degrees for each power impulse. The power impulse, however, is only one of the four strokes which the engine piston makes during this 720 degrees of travel. The first necessary operation of an engine is that some fuel be drawn into the cylinder; the next operation is compressing this fuel, and then it may be fired. This results in the third stroke, and at its completion, the burned gases must be driven out to make room for a new charge of unburned fuel. This is then the fourth stroke. So it is seen that the function of the starting motor, or the hand cranking, is to satisfy the requirements of the first two strokes, drawing in and compressing the fuel charge ready for firing. When the charge is fired the engine then has power from within itself and it will continue to run.

From this discussion it will be seen that there are four strokes corresponding to four processes. The strokes refer to the up and down motion of the connecting rod and piston within the cylinder. Now if there are four of these strokes of equal length, each will be one-fourth of 720 degrees or 180 degrees which is a half circle. From top dead center to bottom dead center is 180 degrees, which properly speaking might be said to be one full stroke. However, and here is where some confusion of the mind of the student is likely to occur, the four operations to the cycle of the gasoline engine are not equal in length. As a study of the inherent principles of the engine proceeds the reason for this will become clear. Just now the fact may be accepted and the difference in length learned. The term stroke used in connection with automobile engines refers to the action of the inlet and exhaust valve, in relation to the position of the piston and its travel up and down in the cylinder.

All engine timing is done with the piston for the first cylinder on top dead center, or within a few degrees of that point. Intake valves are set to open at about 8 to 10 degrees past the top dead center. By referring to Figure 1, it will be seen that the flywheel with the crank shaft throw, and the connecting rod have passed T. D. C. (top dead center) and are on the way toward the bottom dead center of the rod. It will be noted that one of the valve heads has been lifted off its seat, also that the cam nose is supporting the valve lifter which in turn is supporting the valve. This valve starts to open, say at 8 degrees past top dead center, and according to the design of the engine, it will remain open for the full down stroke remaining, and then for about 35 degrees past B. D. C. Instead of the 180 degrees for an actual stroke this opera-

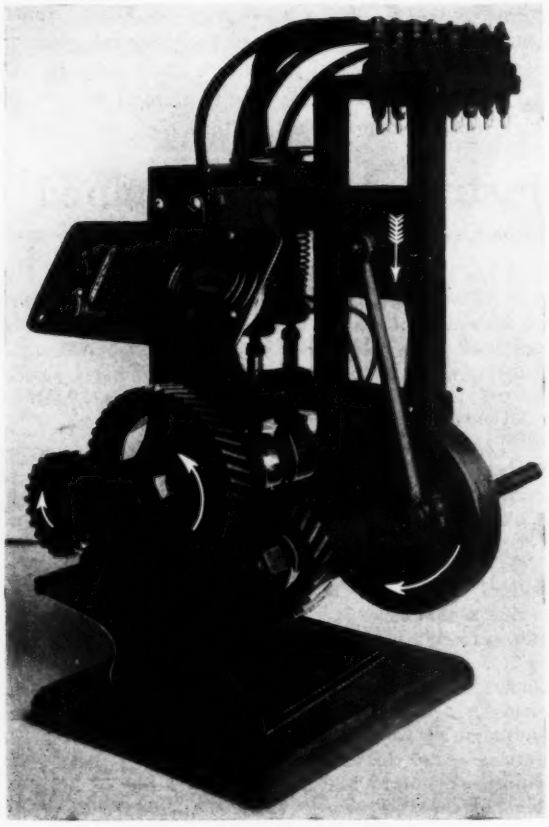


FIG. 1. (FIRST) INTAKE STROKE.

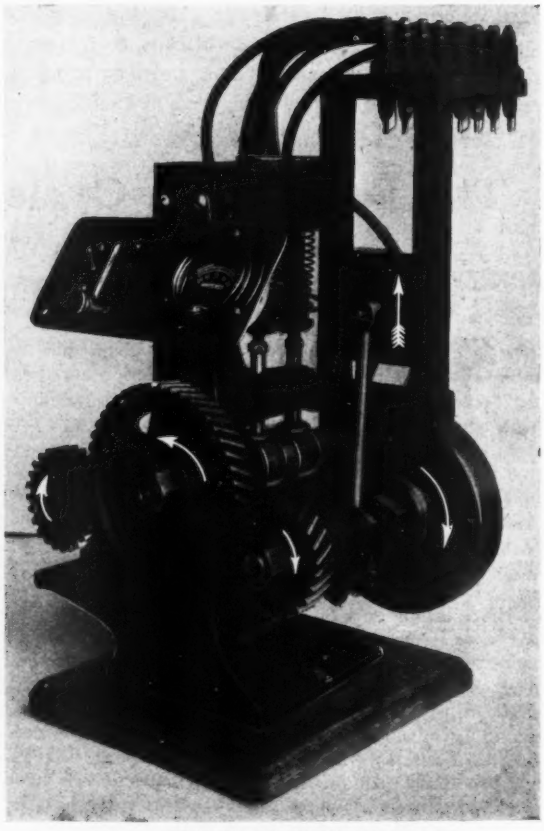


FIG. 2. (SECOND) COMPRESSION STROKE.

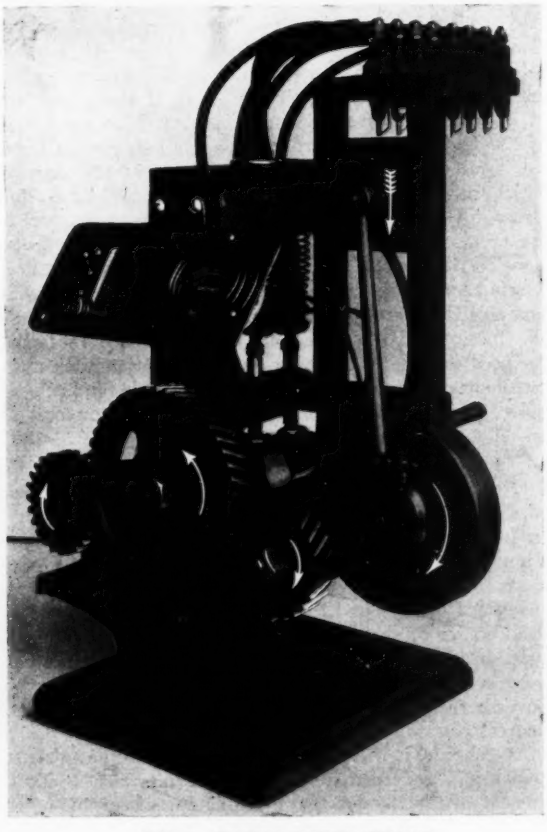


FIG. 3. (THIRD) POWER STROKE.

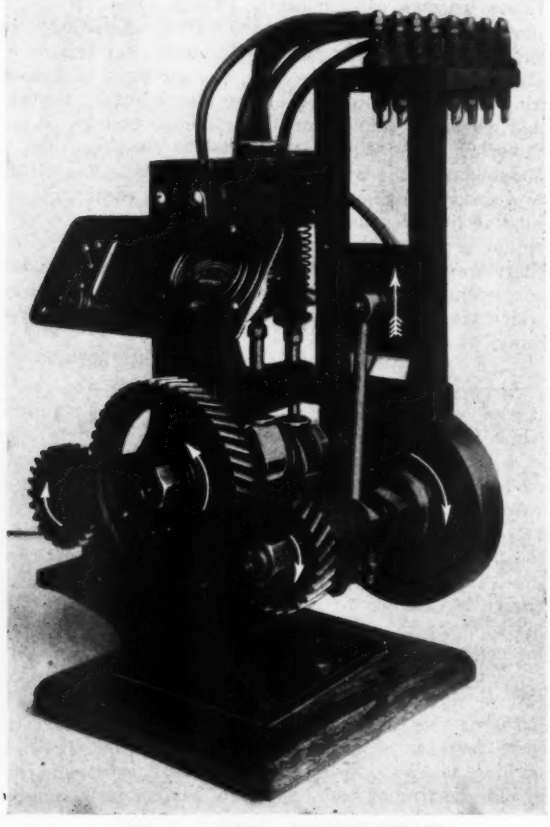


FIG. 4. (FOURTH) EXHAUST STROKE.

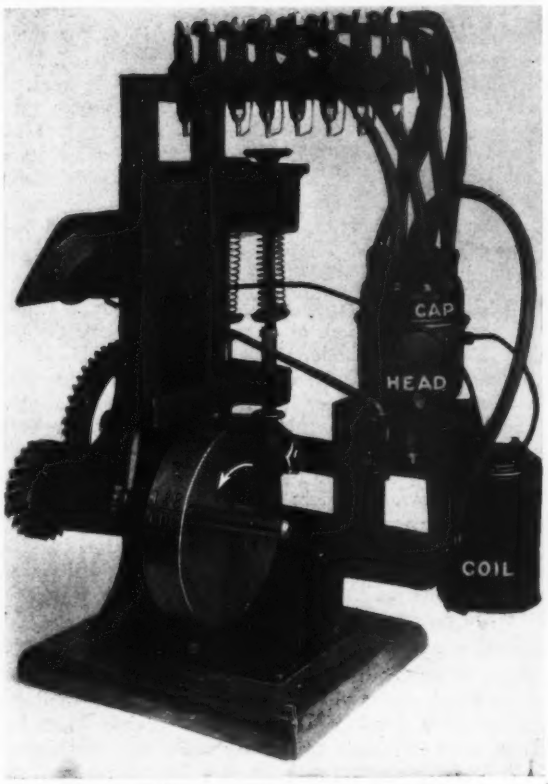


FIG. 5. VIEW OF STAND FROM THE REAR.

tion loses eight degrees at the start and gains 35 at the end, making a net gain of 27 degrees. Add this to 180 and we have the intake stroke lasting for 207 of the 720.

Following the intake stroke comes the compression stroke. Needless to say both valves remain closed while the piston travels up and compresses the new fuel charge. This is evident in Figure 2 where the piston is shown traveling upward. When the piston reaches T. D. C. the spark is set to occur and this fires the charge. Compression stroke then ends at T. D. C. after starting 35 degrees short of a full stroke, so it lasts for 180 less 35 which is 145 degrees. In Figure 3 the valves are closed and the piston starts on the power stroke.

Both valves remaining closed, the charge is fired and power is developed from T. D. C. down. However, this is the shortest stroke of all. When the flywheel and crank shaft have traveled downward about 135 degrees or 45 degrees from bottom dead center, the cam on the shaft under the exhaust valve comes into action and lifts the exhaust valve lifter and valve on its nose, and holds it there until B. D. C. is reached and T. D. C. is reached and passed about five degrees. This gives an extremely long stroke. It is full 180 degrees, plus a gain at the start of 45 degrees, and another at the end of five degrees additional, making it a total of 230 degrees of flywheel or crank shaft travel. Totaling the lengths assigned to the four strokes, we find intake 207 degrees, plus compression 145, plus power 135, plus exhaust 230, and we have a sum of 717. This is three degrees short of the full two revolutions or 720 degrees and these are what is termed a minus valve lap. This is the time when neither valve is open, the time between the closing of the exhaust valve and the opening of the intake valve. Three degrees are allowed here to prevent the possibility of a back fire, which might occur if both valves were open at the same time. The action of the exhaust valve cam and lifter is shown in Figure 4, where the piston is traveling upward on the last or fourth stroke of a cycle.

The word cycle is not always understood by the student. In its ordinary meaning it denotes a completed round of operations or events. When intake, compression, power, and exhaust have occurred in proper order, the cycle is ended and a second cycle is started. Accordingly, we have an endless number of cycles occurring in the cylinders of the automobile engines. In speaking of the automobile and other gas engines, we refer to them as Four-Cycle Engines, the word stroke being dropped. The trained mechanic thinks stroke although he does not say it.

If the full meaning of the four-stroke cycle has been grasped, it will then at once be apparent why great care must be used in timing an engine. Engine timing refers to the setting of the cam shaft and its gear in relation to the crank shaft and its gear. The division of the cycle into its varying strokes is really largely dependent on the cam shaft gear and the cams. The cam shaft is the one which turns just once in completing a cycle. The crank shaft turns twice and strokes are measured in degrees of crank shaft and flywheel travel. The cam shaft turns half as fast, or the relation of the engine time gears is two to one. If there are 24 teeth in the crank shaft time gear, there must be 48 in the cam shaft time gear. This holds whether gear driven or chain driven and whether one cylinder, four, six, eight, or any other number of cylinders.

As a rule time gears are marked in such manner that they are a great aid in timing any engine. The cam gear is the one usually most readily installed, and this is assembled in place after the crank shaft gear is in place, and the engine set up to approximate timing position for all moving parts. That is the cam gear being off, the crank shaft is turned over until the piston in No. 1 cylinder shows T. D. C. and the flywheel markings show T. D. C., provided there are such marks. It is a safe practice then to turn the crankshaft just a bit past T. D. C., a distance corresponding to five to eight degrees. Then with the hands or other means, turn the cam shaft in its proper direction of rotation until the exhaust valve is just closing, and intake valve is just starting to open.

FIG. 6. IGNITION DRIVE SHAFT AND IGNITION HEAD SHAFT WITH CAM AND ROTOR IN PLACE.

The shaft, as a rule, may want to rotate away from this selected point, owing to the pressure of some other valve on a cam, but it must be maintained until the cam gear may be installed. When this operation is being performed, there are several little points to remember. Most time gears are spiral cut. Allowance for this must be made. The cam gear must fit dowels, keys, or possibly screw holes. At the same time, if marks are provided on the gears, they should align properly. A little experience will familiarize the workman with all these points.

After slipping the gear in position and noting that all the above mentioned items are correct, the actual opening of the valves in accordance with the standard suggested by the manufacturer should be checked up. If the manufacturer's specifications for the opening and closing of the valves is not available, the one given here will be found approximately correct. A most important point to remember in testing valve action and engine timing is the fact that the valve clearance (clearance between the valve stem and valve lifter) must be according to manufacturer's specifications. If this is .004 as recommended for many L head engines, it must be secured exactly. If .015, as recommended for many valve-in-head motors, that figure must be secured. If a test of the engine shows that the valves are opening and closing within a few degrees of given specifications, it is likely that that is the proper position for the gear mesh. On the other hand, if the workman has missed the proper setting by as much as one tooth, the valves will be off such a decided amount that the mistake will be obvious.

An instance is on record of an engine which had been operated for a number of years in which the time gears had been assembled according to marks on them. This engine finally came into a car where the last ounce of power was required. It did not seem to perform right and an effort to make the valves open and close in accord with the manufacturer's recommendations was a failure. Valve clearances were adjusted to attempt to compensate and secure the valve action which would give a smooth operating engine and the full amount of power. In the check up it was found necessary to set the time gears off their original marking one tooth and then every valve on the engine opened and closed in exact accordance with the manufacturer's specifications stamped on the flywheel. Of course this result was only secured when the valve clearance was according to specifications (.004"). Then it was with a decided feeling of satisfaction that the valve action and flywheel markings were found checking to the degree. The power secured from the newly timed engine was satisfactory and greatly in excess of that delivered when the gears were off one tooth.

Here was demonstrated clearly the value of a thorough training in the theory of engine timing and the fallacy of depending too strictly on gear markings. Nor is this theory of proper timing a fine spun one applicable to so-called fine cars only. A Ford mechanic knows that there are definite points for the opening and closing of each valve. When the gears are properly meshed, there may still be slight variations for the several valves, but the thorough mechanic files a valve here, and stretches one there, until each and every valve is opening and closing at the right time. Then instead of a jerky, irregular, operating engine he turns over to the customer a smooth job. The Ford manual gives directions for this operation.

Incidentally, it might be mentioned that all engine timing is not done from the flywheel and crankshaft. Some manufacturers specify a certain travel of the piston down into the cylinder. For instance, the manufacturer may specify a certain distance after T. D. C. for valves to open or close, and then other distances from B. D. C. for them to open or close. If this method is used, an approximate figure for the opening of the intake valve is 1/32" from T. D. C. and the exhaust closing at 1/64" past T. D. C. Since the length of the strokes for different engines varies so greatly, it is rather difficult to give figures for the closing of the inlet and the opening of the exhaust, naming them as a satisfactory and safe standard for general practice. Where the method is recommended, the manufacturer will supply exact data.

With an understanding of the theory of engine timing and the practice which gives smooth operation, the student is ready to undertake a thorough study of the mechanism which delivers a spark to the cylinder and fires it at just the proper instant, or in common parlance, ignition timing. Unless the properly timed engine has a properly timed spark, it will not operate satisfactorily. The cam gear is driven by the crank shaft gear, and in turn the cam gear drives the ignition drive shaft. As a rule other accessories are also driven from this shaft as, for instance, the pump and the generator. In the case of the model illustrated, the ignition-drive shaft turns at crankshaft speed. This is quite general practice although not the only possibility.

On the end of the ignition-drive shaft in the model, Figure 5, appears a small bevel gear which drives the larger bevel gear used to turn the shaft in the distributor and ignition head mounted on the U-shaped bracket. These gears are again two to one ratio, so that while the ignition-drive shaft travels two revolutions for each one of the cam shaft, the shaft carrying the cam and rotor in the ignition head travels at cam shaft speed. Here, then, is encountered the essential element of ignition timing. The rotor within the distributor must turn once for each two turns of the crankshaft, just as must also the camshaft or as commonly spoken of, it must turn at camshaft speed. In the case of battery ignition, it is the usual practice to have as many points to the cam operating the breaker arm and points, as there are cylinders to the engine, and this cam is mounted just below the rotor which rides on the top of the shaft. This arrangement appears in the setup in Figure 6 which is the ignition-drive shaft and the ignition-head shaft from an ignition device for a four cylinder engine. Where this cam has four points and breaks the points four times per revolution, there are eight points on the cam for the ignition device on the model. This means that it breaks the points eight times for each turn of the ignition head

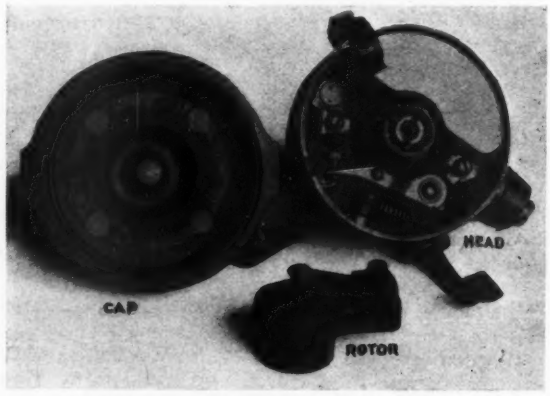


FIG. 8. IGNITION HEAD FOR A FOUR CYLINDER ENGINE.

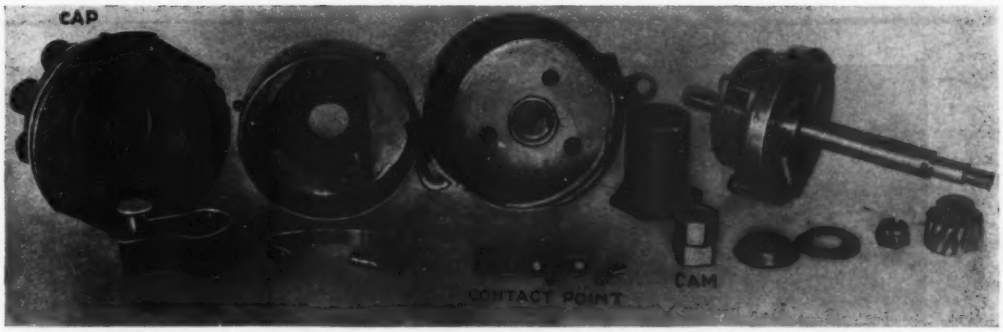


FIG. 7. IGNITION HEAD FROM INSTRUCTION STAND, DISASSEMBLED FOR INSPECTION.

shaft and, as a result, there are eight sparks delivered to the rotor at its central point and from it distributed to the eight points or brass inserts in the distributor cap. Note the lay-out in Figure 7.

What the breaking of the ignition points actually means is illustrated in Figure 8, where the fiber rub block of a breaker point arm is actually resting on one of the four points of the cam illustrated in Figure 6. It will be noted that the movable point on this contact arm has actually separated or broken from the fixed contact point, leaving a minute distance between them. While not taking time to go into the theory of the production of a spark when the points are broken, at this time, it is enough to mention this operation as the key one to the production of a spark at the plug, and to further state that this key operation of the breaking of the points must be made to occur, or timed, so that a spark is delivered to the cylinder to be fired just at the time it is on T. D. C. and ready to start the power stroke. If the spark occurs too early the engine will kick back against the cranking operation; if too late, power will be lost. If a considerable distance from the proper point, misfiring of a serious nature will result.

The model illustrates a simple spark advance or manual spark control. After the engine has been properly timed or checked for correct timing, the next step is to bring the piston in cylinder number one (the only one shown in the model) to T. D. C. at the end of the compression stroke, and just ready to start down on the power stroke. Next place the spark control rod in retarded position. Do not depend on anything but actual observation of the action of the rotor within the distributor head for this. Retarding a spark device means always, the moving of the breaker points in the direction of rotation of the rotor and shaft, as far as they will go. In most cases this means moving the entire igniter head, but not in all; the mechanic should therefore inspect the points and move them as far as possible with the direction of rotation. This has the effect of putting off the time when the cam will catch up with the points and cause them to separate. Since there is no advantage in having the spark occur after T. D. C., engines are timed with the spark device retarded. With the engine on compression stroke at T. D. C. or just a few degrees past, with the spark control retarded and with the rotor out and the cam free on the shaft, the next step is to move the cam until it is just on the point of striking the rub block on the movable contact arm, thus opening or breaking the points. Hold the cam at that point and tighten the lock nut on it, thus securing it in position. Place the rotor on the top of the shaft. It will fit but one way, and then install the distributor cap temporarily. Note which segment of the cap or which brass point or wire in it is in proximity to the outer end of the rotor. Run a wire from this to the plug for cylinder number one and the task of timing the ignition is complete, in so far as the breaker points and cylinder number one is concerned. All that remains to complete the entire job is to run a wire from the second point on the distributor cap to the second cylinder to fire, and one from the third point on the cap to the third cylinder to fire, and so on until all cylinders have been connected to the distributor cap.

The method just given will serve nicely for the theory. Actual practice varies from it by a few rather unimportant details. These details are largely a matter of convenience or changes made necessary due to the varying construction of different models. In the first place some shafts are made integral with the cam and gear. This prevents any adjustment of the cam, except as the gear turning the shaft is lifted out of mesh with the gear driving it and remeshed. In other cases, the gear at the bottom of the shaft is on a taper, and it is necessary to do the adjusting at that point. It is also true that most distributor caps are marked for the cylinder to which the wires are to run. In such case the cam should be turned on the shaft, until it will bring the rotor in position under the segment of the distributor head bearing the number 1, and then the final adjustment made to have the points just ready to break, before locking it tight. Wires will then be of the right length and all things work out to better advantage. A little careful inspection will show these individual characteristics to the student or workman. The point aimed at in presenting this discussion is not to handle the minor differences, but to offer an opportunity for the study of theory which, if mastered, will show that the underlying principles of all automobile engine and ignition timing are the same, and that one who has mastered the theory need not fear its practice, if he but remember fundamental principles.

EXALTING THE SPIRITUAL MAN

"There is nothing great in this world except man and nothing great about man except his mind." With this statement I do not agree in full, because to me there is something more important than the physical life. Spiritual man, when directing physical man, lifts the human mind to the most powerful force in all the world when impelled by proper spiritual motives. In vocational rehabilitation we are engaged in that service of training and redirecting the faculties of the human mind along with muscular force animated by that motive expressed in "Man should earn his living by the sweat of the brow" in order that life, now impaired, might become creative again.

—Homer W. Nichols, State Supervisor of Vocational Rehabilitation, Kentucky.

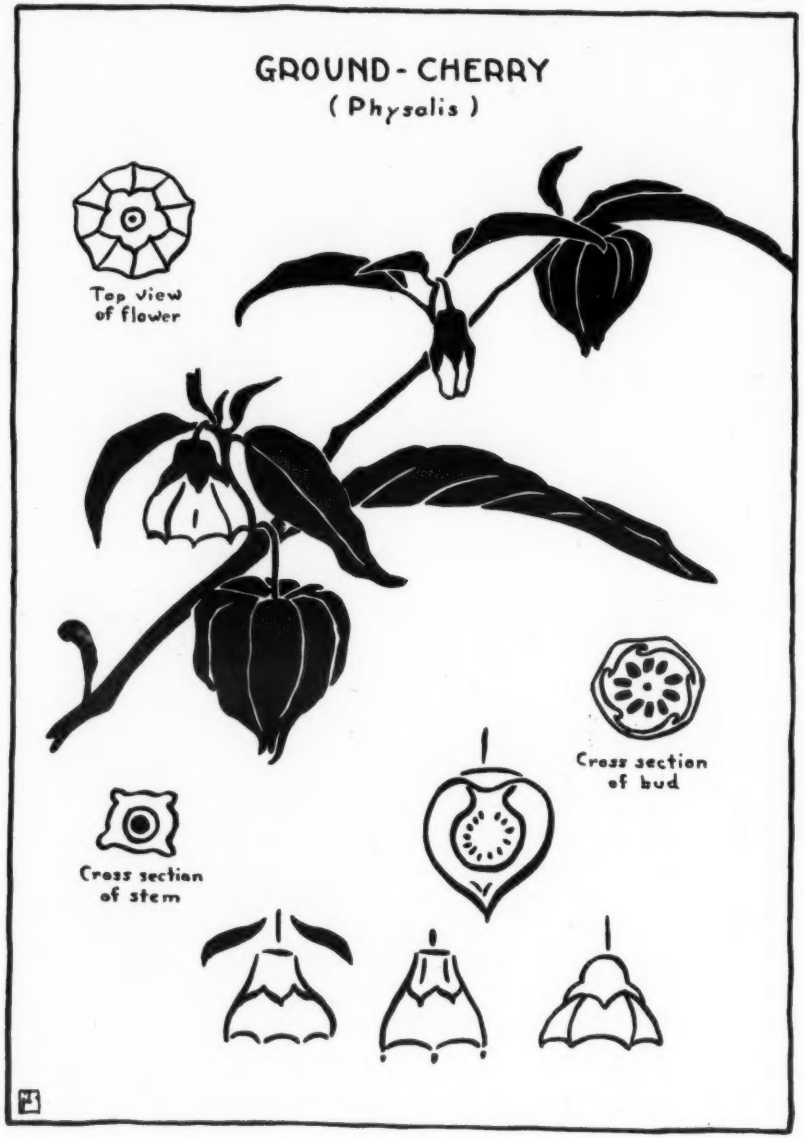


PLATE 11.

PLATE 12.

Wild Flower Designs

Article VI: Brush Work—Batik Simplified

Nettie S. Smith, Smith Center, Kans.

A Brush Drawing of the Ground-Cherry. Plate 11 shows in brush handling, some interesting plant details that can easily be adapted to decorative design. It is interesting to notice here also, a good suggestion for constructive design found in the bell-shaped flower. Its lines and form offer a beautiful shape for an electric light shade. Constructive designs, as well as decorative designs, may thus be derived from nature forms.

Brush Practice. It is well to practice a great deal with a brush, making strokes simple and direct. The brush should be held lightly, almost vertically between thumb and second finger, resting against the first finger. The stroke will be narrow or wide according to the pressure given. A simple leaf can be made with a single brush stroke.

After some practice with plant drawings one should begin making rhythms of dashes, as long, short, long, short, etc., as in Plate 12 (a). Then another rhythm (b), long and two shorts, long and two shorts, counting *1*, 2, 3, *1*, 2, 3, as for waltz time in music. Thus the design can be set to music that is in the same rhythm.

The simplest language of the brush consists of dots, dashes and flowing lines, and it is interesting to interpret some of the plant characteristics in these terms. The cross section of a bud suggested the rhythms (e), (f), (g), and (h) in Plate 12. After copying these, the student will enjoy inventing other figures and borders which the plant will suggest to him.

Ink may be used or black water-color on light paper, or Chinese white and Tempera colors may be used on dark paper. These simple brush designs are effective for various uses.

Batik. Wax designs on cloth act as a resist to dye and produce a beautiful effect called Batik. This ancient art from the Orient has become popular in Europe and America, and if attempted in a simple way is practical for anyone who has skill with a brush and some knowledge of dyes. Batik is a Javanese word, pronounced Bä'tîk.

The Process. There are three principal operations in the work:

I. Applying a design with wax on cloth.
II. Dyeing the cloth.
III. Removing the wax.

I. *The Design.* Before definitely planning the design to use, it is well to try what can be done with a brush and melted wax. Paraffin wax melted in a small pan can be kept at an even temperature on an asbestos pad or in boiling water. A piece of muslin is pinned at the upper edge to a paper, and the paper fastened to a drawing board by the use of thumb tacks. A medium sized or small water-color brush is good for dots and lines. Dashes are easier to make than long lines because the brush must be dipped often, as the wax cools so quickly. And it must be used very hot so that it will strike into the fabric and not merely stop on top or it will let the dye in and spoil the design. With the left hand the cloth can be lifted from the board often so that the wax will not be broken loose after it hardens.

A good craftsman learns the possibilities and limitations of his medium and tools, and then uses them to the best possible advantage. So we find by practice what kinds of brush strokes count for the most, and how many dots to make in a group, and these often help in making pleasing rhythms.

Soft, unbleached muslin, voile and thin silks are excellent for Batik. They should be washed and ironed before waxing because new goods contain starch or sizing that interferes with the dyes. Let us begin with a little cotton handkerchief and afterward the larger and more permanent pieces can be taken up. A pretty figure at the corners and a little border along each edge will be good for the first handkerchief.

II. *The Dye.* A good dye that can be used cold is needed, for hot dyes would melt the wax. Putnam's dye or Bateeko dyes are good. The directions that come with the dyes should be followed carefully.

Since the handkerchief will be daintier if not too dark, it may be held by the center and dipped into pink dye, keeping the center light and letting the outer part have enough color to make a good contrast with the design which is to remain white. Of course the piece will be rinsed in clear water, both before and after it is dipped into the dye. Then it should be laid between newspapers which absorb the moisture.

III. *Removing the Wax.* When partly dry, the dyed piece should be put between fresh newspapers and ironed with a hot iron. This melts the wax which is then absorbed by the soft papers. Some pieces may need to be rinsed in gasoline, then in warm water. If a drop of wax is accidentally dropped where it should not be, it may be removed before dyeing the piece by using two blotters, one over and one under, and the point of the hot iron.

The Steps in Order:

1. Wash and iron the cloth.
2. Wax in the design.
3. Dip the goods in water.
4. Dip in the dye.
5. Rinse.
6. Lay between newspapers.
7. Press with hot iron between dry newspapers.

The process as just described is Batik in its simplest form. It is the custom in Java for the women to apply the designs and the men do the dyeing. One of the favorite color combinations is cream, brown and navy blue. The pieces are made for turbans, scarfs, and sarangs, which are the most important articles of wearing apparel. There are borders similar to those in Plate 12, flowers, butterflies, weird birds, and other fantastic figures.

The Javanese woman sketches in only the most important parts of an intricate pattern with charcoal, then she fills in the background spaces, and the smaller parts of the design freehand, using the tjanting, a special tool for waxing.

Even with the most careful handling there will be accidental cracks in the wax; these allow the color to go through and make fine lines of dark color on the light parts of the design. This crackle is one of the characteristic charms of Batik.

A Voile Handkerchief. Figure (i) shows a design for which the important lines for one quarter were drawn on paper. When the voile handkerchief was laid over it, the lines could be seen and sketched in with charcoal which served as a guide for waxing.

A Crackled Pillow. One-eighth of this design was drawn on a paper of the desired size, and folded as shown in the diagrams for folding and cutting square figures, Plate 10. Then when the important parts of the design were cut out the large paper was unfolded and used as a pattern from which to mark the cloth. The central space was covered with wax, using a large brush. When ready for the dye the piece was put into cold water, then while the wax was brittle, the cracks were made by crushing it sharply in the hands. The dark dye penetrated these cracks and made a beautiful lacy pattern.

A Scarf End. K shows how borders can be combined in a pleasing way for the ends of a scarf. The center of the scarf could be left light by giving it only a tint of color, or it might be covered with wax and crackled.

Before dyeing any piece one should experiment with a scrap of the goods and the colors. Pongee silk is beautiful with a design of the natural color when the piece is dyed in imperial blue dye. A little yellow over this produces a lovely peacock blue. After studying color mixing and color harmony, one will get wonderful blendings of every hue and tint by using only red, blue, and yellow dyes.

Appreciation. And now whether or not the student cares to take up the more complicated processes of Batik, with their intricate patterns, rewaxing and overdyeing, he will have an appreciation for textiles, the beautiful old Javanese Batiks, and the modern American pieces, some of which are also lovely in a different way. A little experience often opens the understanding to a great appreciation of beautiful things.

Brittania Metal—XV: The Touch

Professor William H. Varnum, University of Wisconsin, Madison, Wis.

*"Also, as to those of the trade who shall be found working otherwise tan is before (set forth), and upon assay shall be found guilty; upon the first default let them lose the material so wrought; upon the second default let them lose the material and suffer punishment; * * * and if the third time they shall be found offending, let them forswear the craft forevermore." From Ordinances of the Pewterers, A. D. 1348.*

IN this series of articles much has been written of the high standards of design, materials, and workmanship advocated and enforced by the ancient Guild of the Pewterers of England. To insure quality of materials and workmanship, to trace and punish evaders, various forms of legislation were enacted both by and for this wealthy and respected association. Possibly the most interesting to the craftsman is the touch or mark of identification attached to each legitimately manufactured piece of ware, that is, ware made under the auspices of one of the numerous continental guilds.

Early marks or touches impressed with a die or punch on pewter vessels usually included either the name or initials of the workman or some emblem either with or without the name or initials. Previous to 1503 the touch was voluntary, the matter resting with the worker; after that date the signature became obligatory through compulsory legislation which lasted for three centuries. Legislation mentioned in the foreword became really effective. Violators had their touches confiscated and were obliged to register a new touch to which was appended a knot or a double f. This penalty was so severe that usually the pewterer had to close his shop and begin again as a journeyman. Moreover, confiscated ware of a cheap alloy was marked with a broad arrow and usually destroyed. Needless to say, collectors of today pay well for ware marked with the arrow and which escaped the melting pot. At this, old pewterers must rest uneasy in their graves.

In the Hall of the Pewterer's Company in London, reposed large plates of soft metal called the Touch Plates upon which were registered the maker's touch. While some of these plates have been lost, many remain, records of a long line of departed craftsmen. There are records of these plates from 1500 and the last mark was registered in 1824.

If these records had been properly maintained and preserved, we would have a complete record of the past craft and its workmen. Unfortunately there are many

A BRITTANIA METAL WORKER MAKING A PLATTER.

dateless initials and nameless emblems, slip-shod methods of striking the touch on any part of the plates which happened to be left unoccupied, lost records of identification of touches, leaving evidences of an excellent theory which left much to be desired in clarity. Authorities state that out of 1,200 existing marks only 41 give name and date.

This was due partly to the feeling of the pewterers that while the ware should have marks to identify it with the worker, it was unnecessary to add data to the touch in any way approaching advertising. In other words, a man's ware, its appearance, and the quality of material should speak for itself. The pewterers little realized the interest future generations would take in the exact date of its manufacture and the location of the shop, with other information about the worker. So loath were they

to approach anything smacking of self-puffing that even mention of the name of the city in which the ware was made became illegal.

With the decline of power of the Pewterer's Company, touches with initials were replaced by those bearing the names in full until by the end of the eighteenth century very little initialing was used. Apparently added to each piece was a quality mark or possibly merely the stamp of the Company. The crowned rose, presumably the Company's emblem, guaranteed the quality of the wares in England, but there is evidence pointing to a tendency to avoid compulsory quality marks, with a belief that the Company's mark automatically guaranteed the quality of the ware when made under the supervision of the pewterers' organizations.

Early American pewterers followed closely English customs and the touches show evidences of good die cutting, good lettering and dignified and simple devices.

While the pewterer was allowed to mark wares in his own shop, gold and silver smiths were compelled to visit the Company's Hall, where their ware was officially assayed and stamped, showing much closer supervision. This gives us the origin of the term hall marked silver. As a study of a carefully developed system, much can be learned from the markings of English silver and gold, freely copied by the pewterers regardless of vigorous protests from the goldsmiths' and silversmiths' guilds.

Fine silver is 1000 per cent pure while sterling alloy in this country is 925 per cent pure with the remainder composed of alloy. Thus, in both England and America, the term "sterling" is associated with standard alloys. This term is supposed to have been derived from the fact that the Germans were invited to England by King John for the purpose of reducing silver to the proper fineness of Sterling Alloy. As the Germans were termed "Easterlings" or men who came from the East Country, it is easily understood how the term sterling became a corruption of the Easterlings or the first converters and makers of Sterling Alloy.

As early as 1363, there was enacted by an English Parliament a law requiring all silver and gold plate to be marked with the maker's touch which frequently duplicated his shop sign. This was termed "The Mark of the Maker." One finds a great variety of devices as anchors, geese, acorns, initials, bells and so on as shown on Plate 1; all forerunners of the modern trade mark. With different modifications, *one* of the *four marks* on English silver plate must be the initials of the maker's Christian and sirname.

The second mark must be the Hall Mark of the office or town at which the ware is assayed. From 1478 to 1697 the London assay was represented by the leopard's head crowned. From 1697 to 1719, a figure of Britannia was substituted for the leopard, but from 1822 to the present date, the uncrowned leopard's head marks the London seal. The third mark is the government assay stamp of the lion passant; a tax symbol as well as a guarantee of purity of the alloy.

The fourth mark is a seal of heraldric form but which varies from time to time in shape as will be noted on Plate 1, Figure 4. Within this shield is the date letter. For a given period a certain style of lettering is selected and the letters J V W X Y and Z omitted. This leaves 20 letters, one for each year of a twenty year interval. For example, on Plate 1, Figure 4, we find the capital D in the Lombardic style of lettering. This indicates the year 1601. A capital Lombardic E would designate 1602 and so on. Roman lower case letters would mark a period of 20 years beginning in 1896. This comprehensive system of marking—the maker's initials, the leopard's head, the lion and the date letter and shield—represents a complete system of identification for London gold and silver: the smaller assay towns had a less elaborate system of stamps but offered fair methods of identification and quality.

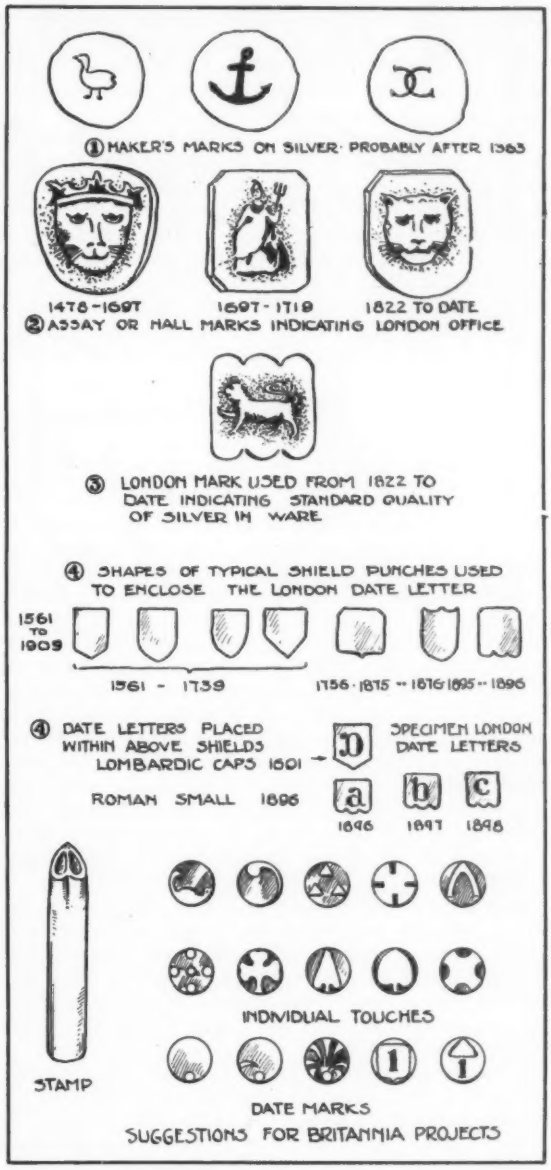

1 MAKER'S MARKS ON SILVER PROBABLY AFTER 1363
1478-1697
1697-1719
1822 TO DATE
2 ASSAY OR HALL MARKS INDICATING LONDON OFFICE
3 LONDON MARK USED FROM 1822 TO DATE INDICATING STANDARD QUALITY OF SILVER IN WARE
4 SHAPES OF TYPICAL SHIELD PUNCHES USED TO ENCLOSE THE LONDON DATE LETTER
1561 TO 1909
1561 - 1739
1756-1815 -- 1816-1895 -- 1896
4 DATE LETTERS PLACED WITHIN ABOVE SHIELDS
LOMBARDIC CAPS 1601
SPECIMEN LONDON DATE LETTERS
ROMAN SMALL 1896
1896
1897
1898
STAMP
INDIVIDUAL TOUCHES
DATE MARKS
SUGGESTIONS FOR BRITANNIA PROJECTS

PLATE 1. SILVER MARKINGS.

During the Colonial period in the United States, there were no general laws established, but the standard of honesty among craftsmen was so high that the maker's name stamped on a piece was its sole guarantee of integrity. The seventeenth century colonial silverworker's mark frequently was composed of his initials and emblem within a shield, occasionally a heart or trefoil.

Maryland was the first state to enact a law designating the quality of silver by its stamp coupled with an obligatory assay: other states followed. At present, the responsibility rests with the manufacturer who stamps his ware Sterling or S or the fraction $^{925}/_{1000}$. Makers

frequently add various touches; four being a common number. The eagle, an old time pewter symbol, is a popular stamp, while an emblem often designates the pattern. The fleur-de-lis thus stands for the Lafayette pattern. The Gorham Company has as its registered trademark the lion, an anchor and the letter G.

In school practice, the designing and marking of projects by touches is to be encouraged. The custom develops a sense of individual responsibility, pride in the quality of the production, and has the psychological value of signing an important document. Touch designing is excellent classroom practice. A few simple touches are illustrated on Plate 1, but stamps may be made to fit certain characteristics or activities of the individual. Symbolical date marks are possible and desirable. A circle may stand for a certain year, and abstract and harmonious forms added for each succeeding year, thus maintaining a class spirit. The teacher could have his quality mark while the parallel to the English system for school application would be complete with the introduction of the stamp designating the governing body or school board. Thus, we would have the individual's touch, the date, teacher's mark, and school board approval mark. Brass or steel rods may be quickly shaped by files and engraving tools into the desired punch. A jeweler's eyeglass with loup will aid in the formation of small details.

This brings the series of articles to its termination with the suggestions for the old-time signature appended to historic metal. Let us trust that designs will be executed with the same pride and care as to the quality and beauty so clearly visualized in the ancient ware, worthy in every way of the pewterer's touch.

The Problem of "Dirty" Cases

Herbert Warfel, Joliet, Ill.

The sad state of having a little bold type in the lightface case, or some italic among the old style, seems to spare no school printshop. The little grade-school shop with ten or twelve fonts, including three or four faces, is likely to utter its annoyance in unison with the big apprentice training shop equipped with type in ton lots. In fact, it is not unusual for a commercial-shop superintendent to raise his voice, deploring the way in which his workmen pi the cases, particularly the "plate" gothics. The reason for the complaint is none the less real, in consideration of the fact that there are so few feasible suggestions of measures to prevent the evil. The commercial printer can possibly trace his trouble to a single careless distributer, and remove the cause by means of a little surgery in the vicinity of the pay-roll, but the printing teacher is not likely to find the cause so concentrated nor the treatment so simple in combatting the evil.

An evil, nevertheless, it is. Pied cases, which are serious enough as impediments to production, are especially so as makers of trouble and dampeners of enthusiasm and interest in school. There is nothing so disheartening to an earnest student as the presence of odd, and sometimes unfamiliar, type among the letters he is supposed to have.

The matter is worth serious attention; and any really useful ideas on it ought to be passed along. This is the present intention, although the writer does not pretend to have learned or worked out anything approximating a one-hundred-per-cent solution of the problem. The suggestions here offered, however, are not merely offhand fancies, but have been tried out and proved to be really useful in reducing the vexation of mixed fonts. Some of them might prove valuable to other teachers, even though working under widely different conditions.

A teacher who has the laying out of a new plant in his hands can prevent a great deal of the anguish at its very source by disobeying that natural impulse to see how many different kinds of type he can buy with the money at his disposal. It is the part of economy as well as of pedagogy to adhere to one good family of type, preferably a representative modern or a genuine old style. This, with a font or two of the opposite sort for purposes of comparison and contrast, and some text-letter and plate gothic will meet the needs of the ordinary school projects, and will lessen the possibilities of confusion which would exist in a more widely diversified layout.

Another help in preventing a great deal of the trouble —a help which is within reach of any school not on the verge of bankruptcy—is this:

Have an individual case of body-type for each student who is working on straight matter, especially beginners. Put the name of the student on the label and let no one else use the case, set out of it, distribute into it or molest it in any way. Hold the student to whom it is assigned responsible for its condition at all times, and especially at the time he turns it over to his successor.

The necessary extra equipment for this plan is not expensive. If, for instance, you are now making your cases do for five classes in rotation; that is, if you are now working five students a day at each case, divide the contents of each case into five cases. To offset the loss in flexibility, you should add about twenty per cent more characters and about thirty per cent more quads and spaces (although if your supply was ample before this may not be needed) and you will have enough.

The extra cases are not very costly and an increase, if necessary, of twenty-five per cent of your body-type investment is not such a great item, and the good it will do in promoting the habit of orderliness, as well as in preventing the practice of passing the buck when blame is to be placed for pied cases, will repay the cost over and over. If necessary, I believe the investment could be justified on the basis of production; although for a school shop it should be sufficient to show its possibilities in the formation of habits of order.

These habits will persist after the student has outgrown exclusive devotion to body-type, if a reasonable amount of help is given him in keeping the display type in condition.

In keeping the display type where it should be, there are at least two useful aids. The first is a semisemester (or more frequent) cleanup; and the second is the verification of the faces before distributing.

In the semisemester cleanup all the eight, ten, and twelve-point display type is set out, each character in measure a little narrower than its box. As the student discovers type of his own font in the wrong box, he stands it on its feet in its rightful place. When he runs into a wrong-font character or space, he gives it to an advanced student who has been assigned the duty of returning such type to its place. The student setting the case out gives special attention to the quads and spaces. Before the case is considered done it is inspected by the instructor.

Of the six-point only the quads and spaces are set out and each of the other boxes is very carefully looked over for wrong-font nicks. As in the other cases, the inspection of the instructor is necessary before the job is called finished. The reason the six-point is not set out

A USEFUL OLD ENGLISH ALPHABET BY W. BEN AND ED. HUNT.

is simply that setting out a case of six-point takes more time than the type is worth, and that keeping students at so tedious a task is likely to destroy his interest in printing forever.

The type above twelve-point is treated in the same manner as the six-point, but for another reason. Pi is less frequent in the larger sizes and the greater variation in thickness of the various pieces makes most out-of-place type distinguishable without setting it out.

To preserve the condition of the cases as long as possible after they have been cleaned up, each student makes a proof of each job or form before he distributes it, and marks the sizes and kinds of type opposite each line or group. This is verified by the instructor before any of it goes into the cases. In addition, the old admonition to "compare face and nick" is often recalled and the instructor sometimes follows up to see that the student is putting the type in the cases the proof calls for.

The pi that is discovered in the run of a day's work should not, of course, be allowed to accumulate, nor should the student who happens to discover it be penalized and distracted from his own pursuits by being made to care for it. Such a course frequently leads to the secreting of pi, which only aggravates the condition.

A good, if not beautiful, expedient in caring for such pi is a receptacle placed in plain view on the stone, into which any stray characters are dropped. If the student finds a good many in the case he is using, he may lay them aside until he is done with the case, and then put the pi in the receptacle. At various intervals, so arranged as to distribute the load, the students sort the accumulated pi into piles according to size, and then each of these piles is sorted according to nick, and in case of duplication of nicks when still further sorting is necessary, according to face. Then each pile is set in a stick and distributed into its case. Even beginners take a hand in the proceeding, as it gives them a chance to get acquainted with the different types under supervision which prevents their making more pi, as would be the case if they were allowed to attempt to distribute wrong fonts as they found them.

This process usually disposes of two or three days' collection of pi in ten or fifteen minutes.

Except in the regular pi distribution, beginners should not ordinarily be trusted with the distribution of any but their body-type. Still less should pi sorting be used as a punishment, unless the intention be to "sour" the victim on printing forever. If a student pies an extensive form or a case of small type, the last thing in the world should be to punish him with the tedious drudgery of distributing the pi single-handed. Unless the accident was due to malice or the most flagrant of carelessness the occasion calls for regret and admonition rather than recrimination, and as many other students as can be used on the job should be assigned to help return things to a state of normalcy without delay.

The effectiveness of these plans, or of any other, rests upon the sincerity of the instructor's purpose to keep his house in order. If he holds distribution as of minor importance and leaves it to look out for itself while he attends to more productive matters, he will soon find that loss in efficiency and interest due to type being out of place, will more than offset the time and effort necessary to keep everything as nearly as possible in its place.

TABLES DESIGNED AND MADE BY SENIOR STUDENTS, MILWAUKEE NORMAL SCHOOL.

INDUSTRIAL-ARTS MAGAZINE

E. J. LAKE S. J. VAUGHN
Editors

OBEDIENCE

The idea of obedience has for a long time been submerged by all sorts of notions of liberty, initiative, originality, etc. Obedience has quite largely gone out of the home. It is not always present in the school. It does not appear conspicuously on our streets, or in our personal and business dealings.

Obligation rests very lightly upon the present generation. Time was when a man's word was really as good as his bond. Men used to borrow money and lend it, with no notes drawn and no records kept. They used to buy goods and sell them, without being looked up in Bradstreet's and with but the simplest bookkeeping. Obligations were kept; the bills were paid. The repudiation of a debt was for only the ne'er-do-well and the town crook.

It seems sometimes that these conditions have changed. Even notes and bonds are not always good, and every possible device and subterfuge are resorted to in refusing, protesting, and disclaiming perfectly apparent and reasonable obligations.

Where's the fault? Well, the faut lies at numerous doors; too numerous, in fact, to rehearse with profit. It will be far better to try to find at least a partial remedy. The breakdown of parental authority in the home is a large factor in the situation, and this can only be corrected by raising up a better trained generation. This task, like nearly all social problems, falls to the schools.

The greatest contribution that the schools can make to this end is to teach the young generation that all acts and movements and thoughts are in obedience to fixed laws. All of life and all of work are responses to principles and laws. There is no caprice in nature just as there can be no effectual and beneficient caprice in life.

The shop is the greatest place in the world to teach these basic truths. The workshop is concerned largely with exact truth. In the shop, the work must tell the truth and obey absolutely the laws of the materials and construction, or else it must come to failure. *No excellence can be attained in any sort of skilled work without complete obedience.* All experimentation, all freedom of design or construction, all initiative, and all effort come entirely to naught, if they do not bring the pupil to this inevitable conclusion. It is infinitely more important for such truths and principles to be realized by the pupil from a problem of construction, than it is for the product to be excellent in construction and appearance and marketable in quality.

If the teacher of shop work has such a vision as reaches clear beyond materials and methods and grasps the essential lesson of all industrial arts work, he will so conduct his work and so inspire his classes that the major result of his efforts will be a keen and accurate sense of the necessity of *Obedience.*

THE MECHANIC'S WASTED TIME

A good deal of the high cost of living is due to the waste of time which somebody has to pay for. Each article one buys has bound up in its production or distribution costs a large element of wasted time. A visit to the average garage will convince one of this fact. A case in point is where the car owner drove into a garage for a slight repair. An unimportant bolt was missing, if there are any unimportant bolts in a car.

The mechanic found the place where the bolt was needed. Then, leisurely he walked across the garage and dug for fifteen or twenty minutes in what a printer would call a "hell box." Returning to the car, he tried out the bolt for size. Then, just as leisurely as before, he went to another box of nondescript parts and odds and ends and fished around another twenty minutes to find a nut that would fit the bolt. When these two long lost friends were finally brought together and the bolt fitted to the part in need of repair, almost a whole hour had been consumed. When the car owner asked the price, the mechanic said, "O, ten cents for the bolt and about an hour of time; O, make it a dollar ten."

This is a real but not a typical example. So-called mechanics in almost every line are frittering away time and doing almost nothing and are charging heavily for time, skill, and labor, when nothing was used but time.

The proper evaluation of time is one of the most important necessities of modern life. It should be one of the prime duties of the school to give each pupil a keen sense of time and its value. It seems trite and commonplace to say that time is about the only thing in life that's limited. In the workaday world, someone always has to pay for the time. If it is wasted, there is a net loss to the individual who pays the bill.

Greater emphasis should be placed upon the time element in the shop courses. The quality of one's work should be rated, at least, partially and materially on the basis of the time involved in the project as compared to the reasonable or standard time it should take to do it. With this type of training in a school shop, the auto mechanic, the carpenter, the electrician, and even the much abused plumber would count every minute and make every minute count for his employer and for the man who ultimately pays the bill. No other method is honest; and an honest piece of work in an honest day at an honest price is the crying need of the world right now.

AMPUTATING THE VITALS

Some schools that are under most generous conditions are cutting out the eighth grade with the result that children may enter high school from the seventh grade and be eligible for college at 17 years of age. We believe that in every case where this is done it is done by the omission of desirable study of the in-

dustrial and fine arts. There are few schools that impress the art and industrial interests effectively. With these vital subjects crowded out in many cases by a routine of academic study; with the majority of high school and college graduates recalling much of their school study as of little value to them in after life; with the increasing need of specific vocational and avocational training in the schools; it is difficult to understand the logic which shortens the school period by a year taken from the most impressionable age of childhood.

If the seventh and eighth grades are so alike in subject matter there should be opportunity to do some much needed practice and study of the industrial, domestic and fine art interests that every person senses the need of. To eliminate the eighth grade means that more study may be added to the high school and college period. This may be desirable but will not reach the majority. We know that children might learn to employ much higher esthetical and industrial standards if given the opportunity. Every child of normal mind and body might become appreciative of good music, good design, better living if given training to that purpose. Every child of normal faculties might become skilful in some expression of art and life if given persistent and efficient training.

Certainly these are vital accomplishments for which the schools are responsible. To direct the work of the lower grades to the purpose of entrance to high school and college, which is based on a few selected academic studies, is to miss the aim of the grade schools entirely.

To omit the eighth grade is to admit that there is time enough in which to train and develop our children better in the schools.

WHAT IS THE MATTER WITH MABEL?

I might as well explain that Mabel Prue and I are to be married at Christmas. Mabel teaches Art, and I am only the Manual Training teacher of our town schools. We were window shopping Saturday evening and our Industrial Art curiosity was aroused by a fine piece of cabinet work in a window display.

It looked like a big phonograph but it was in a hardware store and had a smoke vent on it. The salesman discovered us looking at the thing and stepped to the door quickly.

"Interested in heaters?" he asked.

"Heaters!" we exclaimed together.

"Yes, this is our new Victrola Heater, the latest thing in stove design; isn't it a beauty?" he asked proudly.

It was a good looking piece of furniture so I replied without hesitation "Yes, but why a Victrola Heater?"

"Well!" said the salesman; "you see phonographs have been made very attractive in design, but phonographs are now replaced by the radio. On the other hand stoves have never been made attractive pieces of furniture, but are a household necessity for several months of the year. So you see the designer of stoves has cribbed the Victrola, and now we may enjoy the radiation of heat in place of music from a beautiful music box by putting a stove pipe on it."

"But what is to keep this beautiful wood from burning up?" we asked.

"Burn up! Wooden!" exclaimed the salesman; "this is not wood; it is the best rolled steel plate, with cast steel trimmings, and is guaranteed not to tarnish or change color. This finish is a perfect substitute for wood and is made in a variety of styles to match the wooden finish and furniture of the room. It will last longer than other furniture and may be cleaned with impunity."

"But don't you have it in a finish that looks like metal; that looks like a heater; that looks as though it would not burn?" asked Mabel anxiously. "I would feel as though I was setting the house afire when I kindled up this wooden Victrola Heater in the morning, and I would be fearful of burning my fingers in the absent minded attempt to crank it up in the evening as a phonograph."

"No," said the salesman with a sad, suspicious glance at Mabel. "We have no Victrola Heaters that do not look like beautiful phonographs but we will give you a new one for every one that burns up and we will guarantee it hot enough to keep you from using it as a phonograph."

"Fair enough!" I said thoughtlessly, as I looked closely at the finish on the heater which had fooled me into thinking it was a good piece of white oak wood work. "We must have one of those heaters for our cosy little living room Mabel."

But Mabel had walked on to the next store window. I followed meekly wondering what could be the matter with Mabel and the Victrola Heater that looked like a beautiful phonograph with a smoke pipe on it. I confess I don't quite understand Mabel and her artistic notions, but I am only a manual training teacher.

Dominant local industries inevitably affect the studies in the schools of any community, says "School Life." San Diego, Calif., for example, is on a bay which is large enough to give safe anchorage to 300 battleships, and it is rare that the harbor is without a considerable number of them. Many of the people of the city look to the ocean for their livelihood or for their principal diversion. The courses of the school shops reflect that condition. Nothing else in those shops arouses so much interest as the building of boats and of models of racing craft. Yachting enthusiasts and expert boat builders encourage this study and cordially cooperate with the shop teachers.

Similarly, in Bedford, Ind., the center of a great quarrying district, stone drafting and stone working are strongly emphasized. The senior high school has a complete equipment for planing stone and for shaping and dressing it, and the vocational courses offered are of the most practical character. Numbers of the boys elect those courses, for they are not only of great interest in themselves but they lead to remunerative work after graduation.

Errors in the Use of Common Woodworking Tools

By Charles A. King, Plymouth, N. H. (See Page 439)

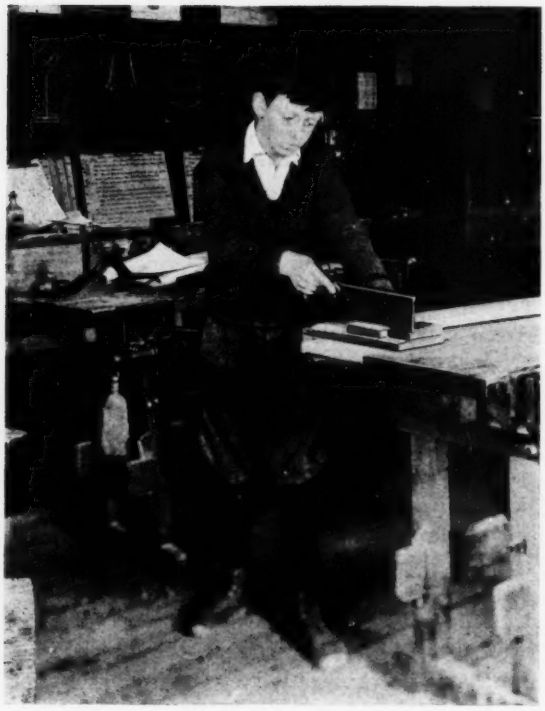
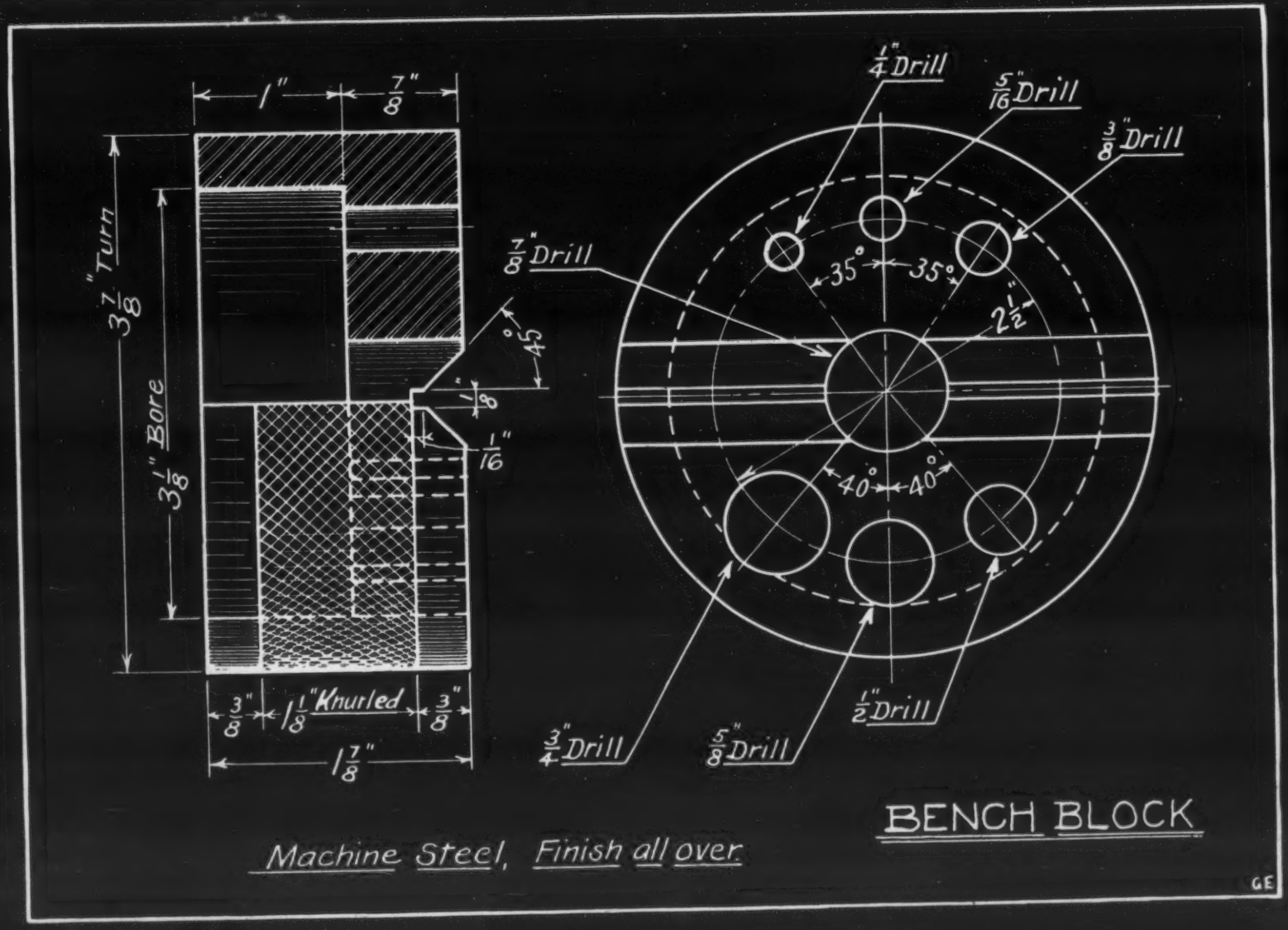


FIG. 1. THE USE OF THE BACK SAW.
In what way may either body position or use of tool be improved?

FIG. 2. USING THE BLOCK PLANE.
Find five errors in body position. Find three errors in tool use.

FIG. 3. USE OF RIP SAW.
Find five errors in position. Find three errors in use of tool.

FIG. 4. USE OF BLOCK PLANE.
Find two errors in position. Find two errors in use of tool.



BENCH BLOCK

Machine Steel, Finish all over

GE

Bench Block

C. S. Jones, Wyandotte, Michigan

This project for the machine shop combines a number of operations and has proven to be a very good exercise from the standpoint of value in machine operations, and has been one which interests boys.

The stock is chucked, and turned to size. The center hole is next drilled out, and boring bar is used to size the inside.

The piece is next knurled and cut off, leaving enough stock to finish the top. The job is then rechucked and faced off to size.

The next operation is to mill a groove to depth and use 45° cutters for "Vs." The placing of the holes can be done with a protractor, and the sizes can be varied as to the particular use to which the block is put.

A variety of sizes can be turned out to this general form, and this, of course, could be determined by the instructor.

SUPPLEMENT TO THE INDUSTRIAL-ARTS MAGAZINE,
NOVEMBER, 1925.

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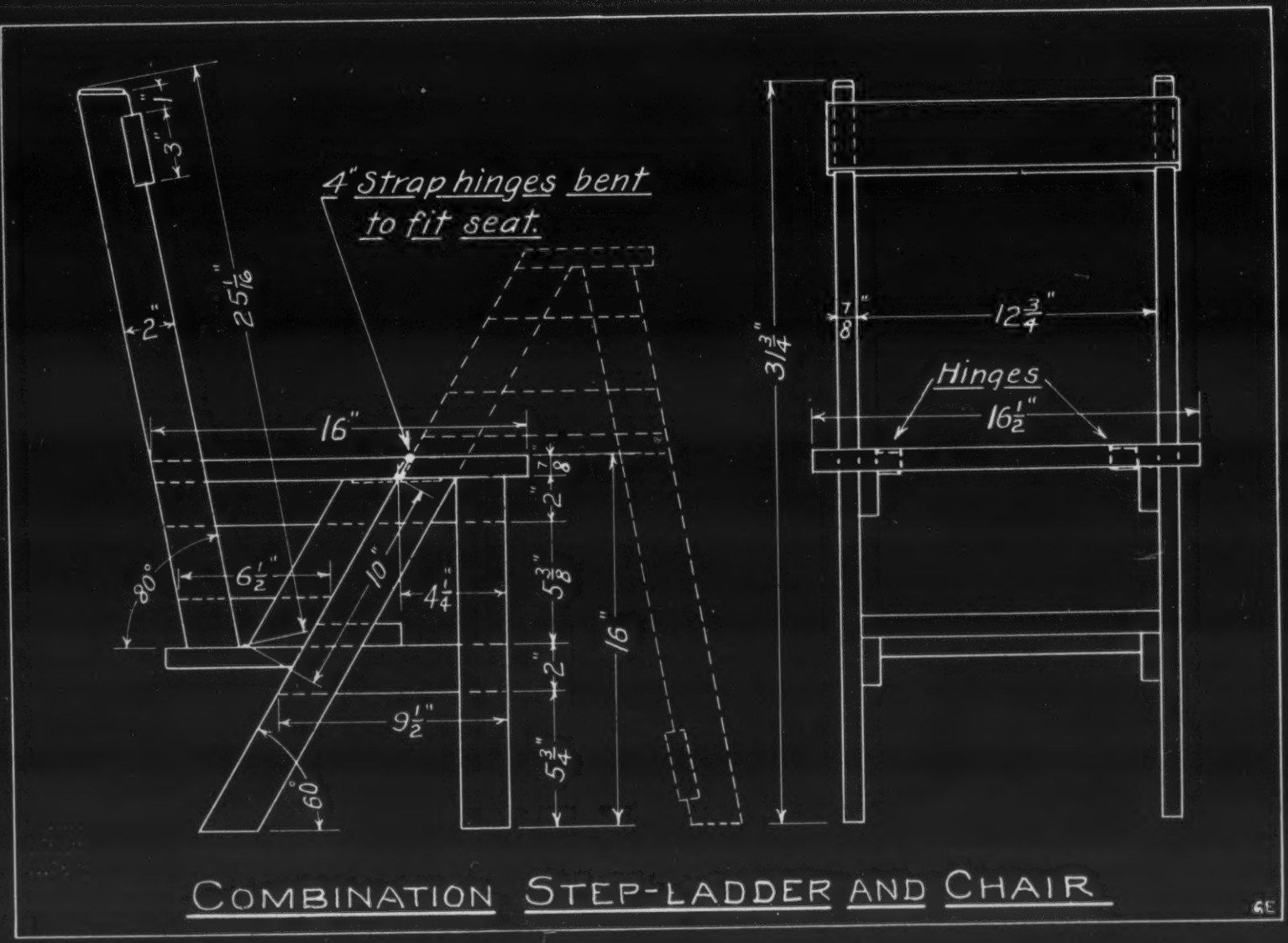

COMBINATION STEP-LADDER AND CHAIR

GE

Combination Step Ladder and Chair

J. H. Thorp, Charleston, West Virginia

This step ladder chair was designed for a backward group of eighth grade boys. The main purpose was to thoroughly teach them to square up stock to a given size. It will be noticed that there are several pairs of pieces which must be exactly the same size. All bevels are cut either 60° or 80° and can best be cut with a miter saw. The hinges used were four-inch straps, which were beat to fit so that they could be mortised between the sections. They could also be used flat on top, but when mortised they give a neater appearance.

This problem was very popular with the boys, and when finished, it is a very useful piece of furniture to have about the home.

The step ladder chair can either be painted, or stained and shellacked. As a rule, paint is a little more satisfactory, considering the use it will be put to.

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PROBLEMS & PROJECTS

This department aims to present a wide variety of class and shop projects in the Industrial Arts. Successful problems are invited and will be paid for. A brief description of constructed problems, not exceeding 250 words in length, should be accompanied by a good working drawing. The originals of the problems in drawing and design should be sent.

Problems in benchwork, machine shop practice, turning, pattern-making, sewing, millinery, forging, cooking, jewelry, bookbinding, basketry, pottery, leather work, cement work, foundry work, and other lines of industrial-arts work are desired for consideration.

REVOLVING RACK FOR MILLING MACHINE CUTTERS

J. A. Miller, Director of Vocational Education, New Kensington, Pennsylvania

Taking care of equipment is one of the essentials in the organization of any shop, but more so in the school shop where space is often limited. To get more material and a greater number of machines into a given space, allowing plenty of room to move about with safety, is a problem that constantly faces the shop teacher.

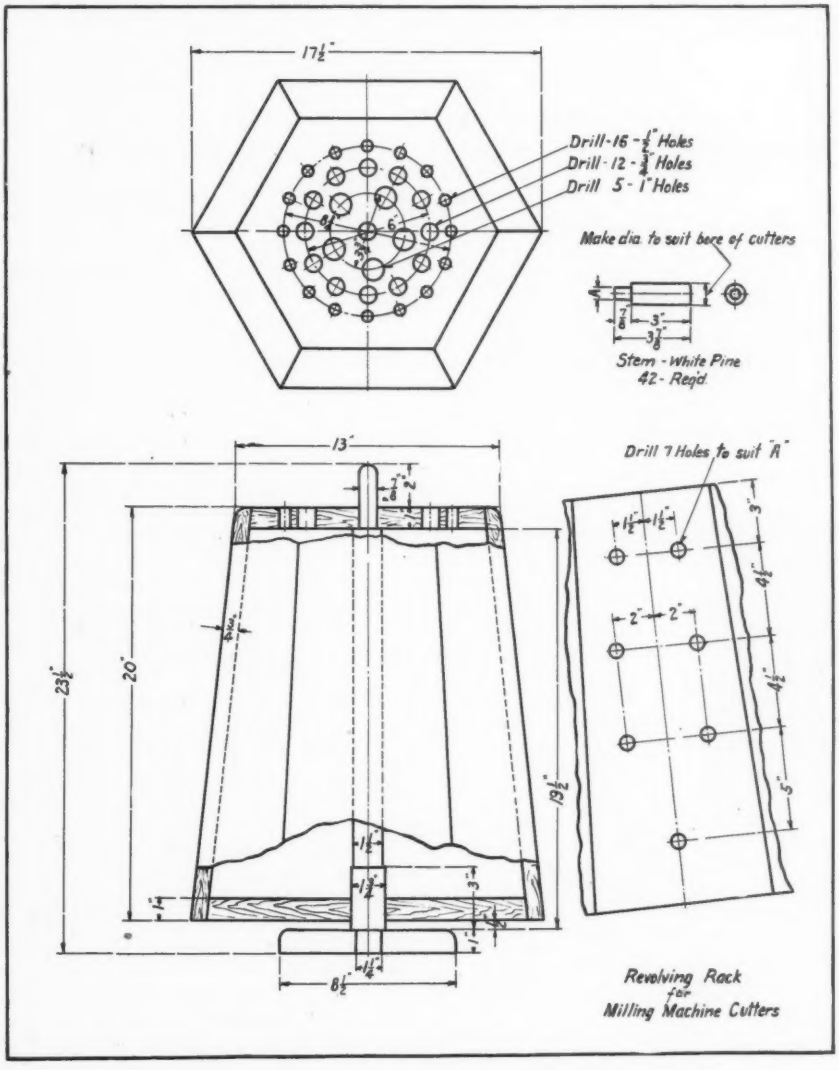
The drawing of the revolving rack takes care of 33 end mills of various sizes and from 42 to 252 or more milling machine cutters, depending upon their thickness.

It is very easily constructed by making an inside pedestal, turned to suit the openings in the top and bottom of the hexagonal rack. The base of the pedestal is fastened to bench, table or in some convenient place by means of wood screws.

The rack is slipped over the pedestal, and is held in position ½" above the base by resting on the enlarged diameter of 1½". The ⅞" and 1¾" diameters act as bearings for revolving it.

Stems as shown, are turned and fitted into the 7 ½" holes on each side of the hexagon. The milling machine cutters are placed on these stems, while the shanks of the end mills fit into the holes drilled in the top.

The rack should be tapered in order to avoid top heaviness.



DETAILS OF REVOLVING RACK FOR MILLING MACHINE CUTTERS.

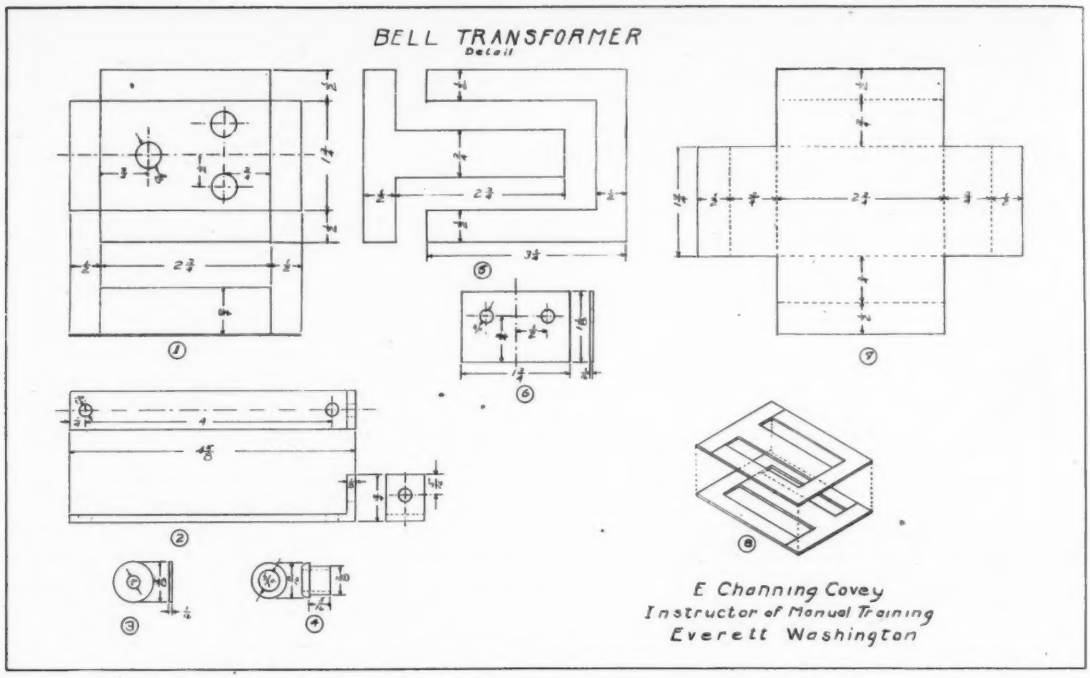
BELL TRANSFORMER

E. Channing Covey, Everett, Washington

The bell transformer makes a very practical, interesting, and instructive project. The transformer is a practical project, because it fills a real need. The use of a bell transformer is the most economical way to operate a bell system. Dry cells have to be renewed frequently, depending on the amount of use. They usually cost fifty cents each, while the bell transformer costs about a dollar, and once installed, the current it uses is negligible.

In the construction of the transformer, there is a broad field that may be covered in the theory of induction, magnetism, and alternating currents. The principle in the design of small transformers is the same as in the large commercial types. The construction of the bell transformer gives the student experience in the manipulation of various materials as it involves metal work as well as electrical.

In Fig. 1 is shown the transformer complete. In Fig. No. 2, part No. 1, is a sheet of iron in the form of a rectangle with the "T" and "C" marked. The piece makes one of each. No. 2 is a "T" and No. 3 is a "C" cut out and straightened. No. 4 is the back cover, and No. 5 is



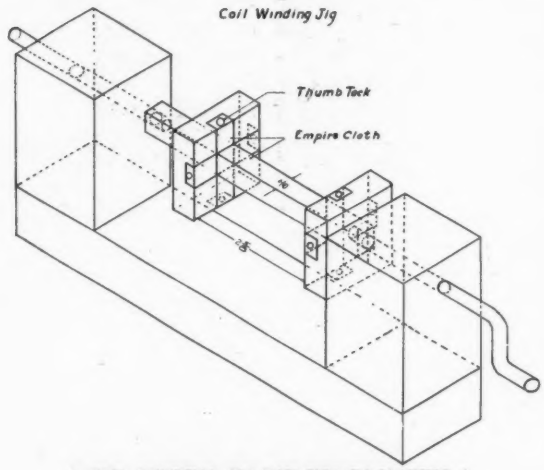
DETAILS OF AN ELECTRIC TRANSFORMER FOR RINGING HOUSE BELLS.

the front. No. 6 is the coil wound with the core inserted. No. 7 is the clamps that hold the transformer together and form the legs.

Fig. No. 3 is the detail of the parts as follows: No. 1 covers, No. 2 clamp, No. 3 fiber washer, No. 4 hard rubber bushing, No. 5 "T" and "C," No. 6 fiber support for the secondary terminals, which go inside the front cover at the bottom, to hold the secondary terminals in the center of the holes in the cover. No. 7 is the pattern or layout for the covers. No. 8 is the diagram showing how the core is built up, placing the "T" and "C" alternately in each layer. Two 12-24 brass machine screws are needed for the secondary terminals. Four 3/16"x1' stove bolts are needed for the clamps.

The Core

Transformer cores are of two general kinds, core type and shell type. The shell type is considered more efficient for low voltages, and is used in this transformer.



A COIL WINDING JIG FOR USE IN MAKING A BELL TRANSFORMER.

As shown in the drawing, the core is composed of "Ts" and "Cs" as laminations. In the shell core, there are two parts, the inside core formed by the stem of the "T," and the outside core formed by the "C." In reality there is only one piece as the core is all together, but for convenience, will be considered as two. The combined cross sectional area of the outside core, the parts of the "C," must equal the cross sectional area of the center part formed by the "T." According to this, the center core would be ¾"x¾" and the outside ⅜"x¾". This outside dimension can be increased to ½" or more, in order to give more space on which to clamp the supports. In case this part of the core is made larger, the width of the whole core must be increased, as the space between the center part and the outside must *not be* less than ½". Great care must be exercised in cutting out the rectangles which form the stock from which the "Ts" and "Cs" are cut. The best results are obtained if the stock is cut with squaring shears. If such is not accessible, allowance must be made for filing. The rectangles must be true and all the same size. They should be placed in a vise and all filed at the same time. It will take about 45 pieces. Use No. 28 gauge iron.

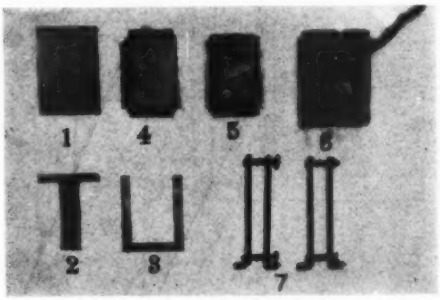
A marking gauge can be used to mark the "Ts" and "Cs" on the sheets of iron. Referring to the drawing, the core is 2¾"x3¾". This will need a piece of the same size to make it. It allows ½" for the outside of the core, ½" for the winding space, and ¾" for the center. Set the gauge ½" mark all around, then set the gauge 1" and mark again. This leaves ¾" in the center. After the "Ts" and "Cs" are all cut, they should be straightened and filed. They should be closely checked to see that there are no air gaps when the "T" and "C" are placed together. They should touch at all three points. It may be necessary to file them where they touch to get a perfect fit.

The Coil

Before taking up the construction of the coil, it will be necessary to discuss briefly the principle of the opera-

tion of the transformer. If the terms used are not familiar to the reader, they may be found in any physics book or in "Crofts Electrical Library."

The inductance in the primary coil is high because it is wound on an iron core. When an alternating current is passed through the coil, it will produce an electrical pressure that is opposed to that which is applied. This electrical pressure that is produced is called counter E. M. F. The coil is so designed that this counter E. M. F. is practically equal to the applied E. M. F., which is the voltage of the line to which the coil was connected. There will be practically no current flow, except a very small amount which magnetizes the core. This current is alternating, therefore it develops an alternating flux in the core. This flux cuts through the secondary winding of the transformer, inducing an E. M. F., also maintaining the counter E. M. F. in the primary. As stated above, the counter E. M. F. nearly equals the applied voltage, so there is no energy used. When a load is applied to the secondary, which in this case will be a bell,



PARTS OF THE TRANSFORMER.

the induced E. M. F. in the secondary will cause a current to flow. As this current flows, it tends to produce an alternating flux in the core. But this flux is opposite to that produced by the primary current, so it will tend to demagnetize the core. When the core is demagnetized, it will decrease the counter E. M. F. in the primary coil. As the counter E. M. F. is decreased, it allows more current to flow in the primary. This action takes place automatically. From this explanation it will be seen that the bell transformer uses current only when it rings the bell. The following formula is used to determine the number of turns to get the above results.

$$N = \frac{E \times 100{,}000{,}000}{4.44 \times F. \times A. \times B.M.}$$

N=number of turns (primary).
E=primary voltage, usually 110 volts.
F=frequency, usually 60 cycles.
A=cross sectional area of center core or the stem of the "I".
B.M.=magnetic or flux density or number of magnetic lines per square inch (about 30,000).

Substituting the known values in the equation.

$$N = \frac{110 \times 100{,}000{,}000}{4.44 \times 60 \times .56 \times 30{,}000}$$

N=2,457 turns.

Since the same flux that produces the counter E. M. F. in the primary also produces the E. M. F. in the secondary, this equation is involved.

$$\frac{\text{Primary voltage}}{\text{Secondary voltage}} = \frac{\text{Primary turns}}{\text{Secondary turns}}$$

This transformer is designed for a secondary voltage of 6 volts. Then substituting in the equation,

$$\frac{110}{6} = \frac{2{,}457}{X} = 134$$

There are some losses of energy in the coil called copper losses and losses in the core called iron losses. No attempt is made to figure them accurately. Ten per cent is added to the secondary turns to compensate for them. This works out about right. Then the corrected number of turns for the secondary will be 134 + 10% of 134 = 147. If other voltage than six is wanted, make the proper substitution in the equation.

Winding the Coil

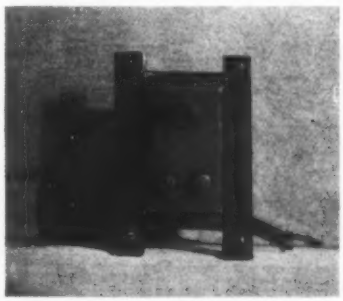
Best results are obtained by using a winding jig. It consists of a wooden core ⅛" larger than the transformer core (that is, the center part), in order to facilitate placing the core in the coil. Two flanges are placed on the wood core to keep the coil the proper length. (See Fig. 4.) A layer of empire cloth is wound around the wood core and extending up the sides of the flanges serves to insulate the core from the coil when in place. No attempt is made to wind the coil in layers. However, if the coil is kept compact, it will give more leeway in placing the core. If a lathe is available, the coil can be wound in layers. After the primary coil is wound, it is insulated by a layer of empire cloth. The secondary is wound on top of the primary. Care should be exercised to make this in perfect layers. After it is wound, it is bound with tape. It would be well to dip the completed coil in boiling paraffin. The primary and secondary leads should be insulated with "spaghetti" as used in Radio sets. No. 31 or 32 D. C. C. magnet wire is used for the primary and No. 22 D. C. C. wire for the secondary.

The Covers

The sheet iron covers are both alike in dimension and shape. (Fig. No. 3, part No. 7.) The pattern for the covers is laid out on No. 20 gauge iron and folded on the dotted lines. The front cover has the holes drilled according to the drawing. The back has no holes in it. The legs or supports are made of ⅛"x⅝" band iron, bent and drilled according to the drawing.

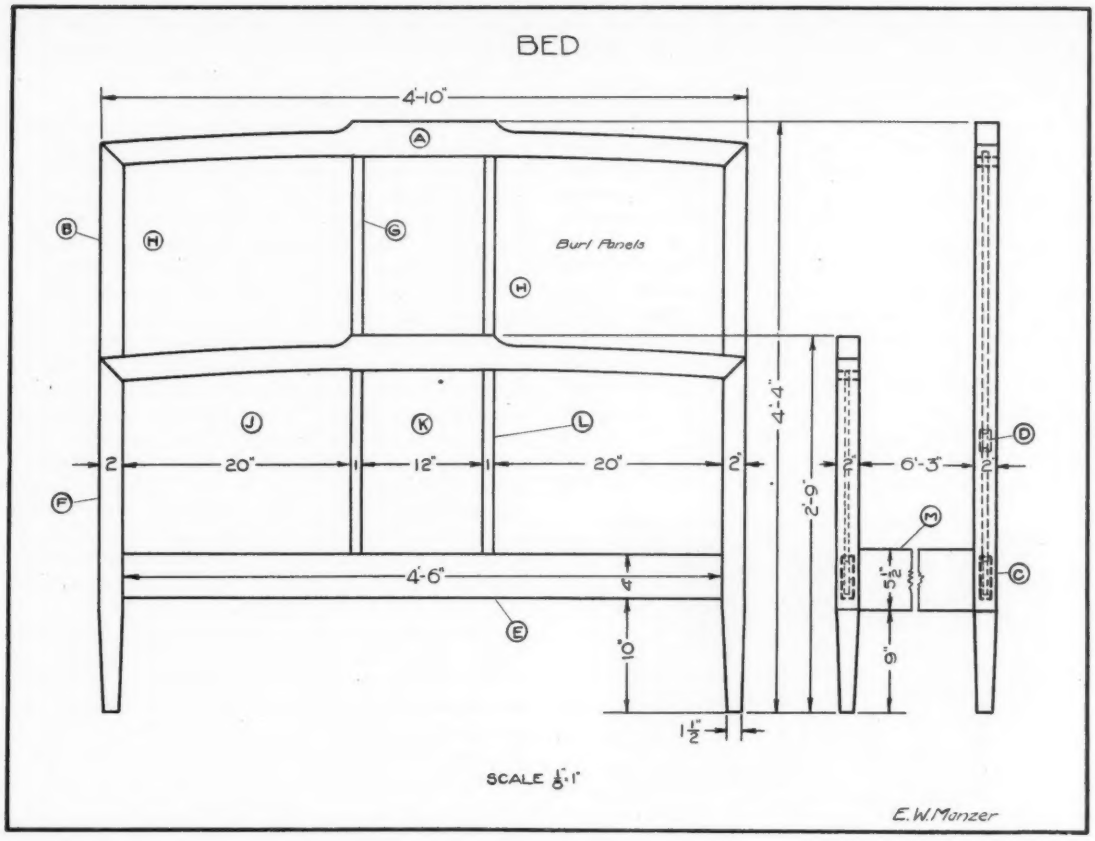
Assembling

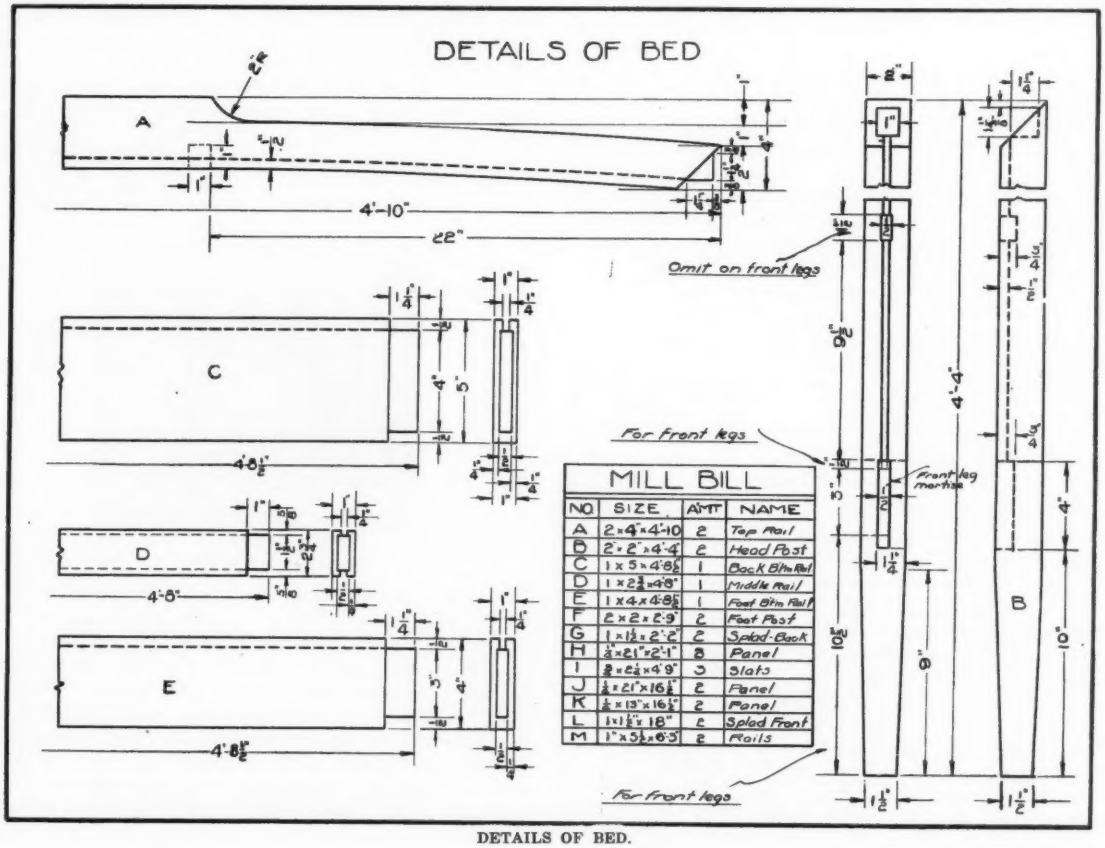
A hard rubber bushing (No. 4, Fig. 3) is placed in the hole in the cover and slightly heated to soften it. It is spread so it cannot pull out. This is for the primary leads. A piece of fiber (No. 6, Fig. 3) is placed inside the front cover, so that the two 3/16" holes come in the center of the two ⅜" holes in the cover. The two 12-24 screws are placed in the holes, the fiber washers (No. 3, Fig. 3) are placed on the screws, and the nuts screwed tightly. These form the secondary terminals. The core is now placed in the coil. If the coil is a little large, due to loose or irregular winding, it may be squeezed a lit-



THE TRANSFORMER READY FOR USE.

tle in a vise. Care must be taken not to increase the length of the coil. Place a "T" in one end of the coil and a "C" around the coil from the other end. Reverse this operation with every layer according to the diagram in Fig. 3. Be sure that they touch at all three points. Continue until the core has all been inserted. A pliable cord should be connected to the primary leads. An Underwriter's knot should be tied on the inside of the cover, so it will not pull through. The primary leads are soldered to the cord and taped. The secondary leads are soldered to the




DETAILS OF BED
4'-10"
22"
Omit on front legs
For front legs
Front leg mortise
For front legs
4'-8½"
4'-8"
4'-8½"
MILL BILL
NO | SIZE | AMT | NAME
A | 2×4"×4'-10" | 2 | Top Rail
B | 2"×2"×4'-4" | 2 | Head Post
C | 1×5"×4'-8½" | 1 | Back Btm Rail
D | 1×2¾"×4'-8" | 1 | Middle Rail
E | 1×4"×4'-8½" | 1 | Foot Btm Rail
F | 2"×2"×2'-9" | 2 | Foot Post
G | 1×1½"×2'-2" | 2 | Splad-Back
H | ¾"×21"×2'-1" | 8 | Panel
I | ¾"×2¼"×4'-9" | 3 | Slats
J | ¾"×21"×16½" | 2 | Panel
K | ¾"×13"×16½" | 2 | Panel
L | 1"×1½"×18" | 2 | Splad Front
M | 1"×5½"×6'-3" | 2 | Rails

DETAILS OF BED.

secondary terminals. The covers are placed over the coil, the clamps put in place and screwed up tight. The transformer is ready for use.

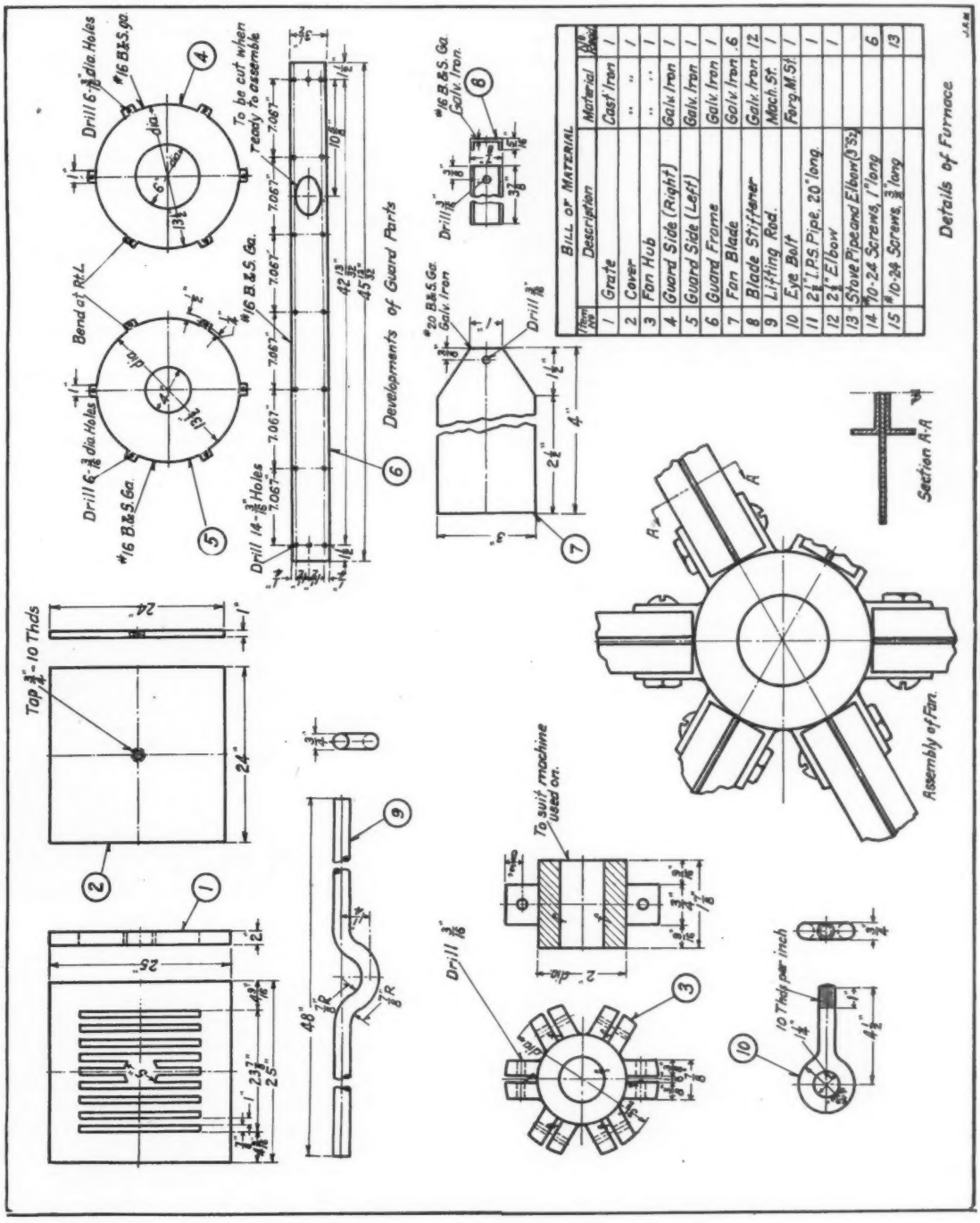
A word of caution: The transformer should never be hooked up backward as it would produce a voltage of about 3,300, and would not only burn up the transformer immediately, but would be extremely dangerous. It would be well to place fuses on the 110-volt side of the transformer to protect it from burning up in case of a short circuit in the bell system.

This transformer has been a very successful project in electrical work in the seventh grades in the Everett schools for the past two years.

A BED

Emerson William Manzer, Central High School, Madison, Wisconsin

The accompanying furniture problem is one that any advanced cabinet-making student would like to make because of its usefulness and need in almost every home. Walnut, mahogany, or gum make up the best looking beds. The burl panels set off the head and foot. There is also room for some surface enrichment on the foot and head posts and in the center of the top rails. Pressed carvings will enrich the design very much. Discretion should be used in choosing and applying the designs, for the major lines of the bed design must not be destroyed.


Bill of Material
Item No. | Description | Material | No. Reqd.
1 | Grate | Cast Iron | 1
2 | Cover | " " | 1
3 | Fan Hub | " " | 1
4 | Guard Side (Right) | Galv. Iron | 1
5 | Guard Side (Left) | Galv. Iron | 1
6 | Guard Frame | Galv. Iron | 1
7 | Fan Blade | Galv. Iron | 6
8 | Blade Stiffener | Galv. Iron | 12
9 | Lifting Rod. | Mach. St. | 1
10 | Eye Bolt | Forg. M. St. | 1
11 | 2½" I.P.S. Pipe, 20" long | | 1
12 | 2½" Elbow | | 1
13 | Stove Pipe and Elbow (3 Sq. | | 6
14 | #10-24 Screws, 1" long | | 13
15 | #10-24 Screws, ¾" long | |
Details of Furnace
Development of Guard Parts
Section A-A
Assembly of Fan.
DETAILS OF FURNACE.

UTILIZING OUR SHOP EQUIPMENT

O. J. Remy and J. A. Miller, New Kensington, Penna.

Comparatively few schools have a course in foundry practice, or even facilities for properly teaching the fundamentals of that particular trade, as a correlating study in connection with pattern making.

It is not right to teach pattern making to boys who expect to become trade workers, without giving them some idea of the enormous loss of time and money which may result from poorly made patterns, incorrect methods of parting, etc. The common errors may be called to their attention, but the significance of the correct methods and processes in constructing a pattern and using it properly, can be driven home more effectively by practical examples.

It was with this thought in mind that we constructed a furnace as shown in the drawing. It can be constructed for a few dollars, especially so if the scrap material which usually collects in all shops is used to good advantage.

The furnace is made of fire brick, using a cement mixture for mortar and lining the inside with fire clay. The entire front is open up to eleven inches from the floor. The only other opening is in the side wall which allows the gas and forced air to enter just below the grate. It should be built as close to an emery wheel as is considered safe.

The wheel is removed and a fan, as detailed, is mounted on the spindle. This fan is encased in a galvanized protector with air openings on the side. On the bottom a hole is cut in to admit an ordinary three-inch stove pipe which carries the air and mixes with the gas. The gas is turned into the pipe near the furnace.

Into the end of the stove pipe and carried on through the hole in the furnace wall is fitted a piece of 2½" I. P. S. pipe, and on the end of that an elbow.

A crucible with a capacity of from 50 to 75 pounds was set in place on the grate and packed with clay balls to distribute the heat.

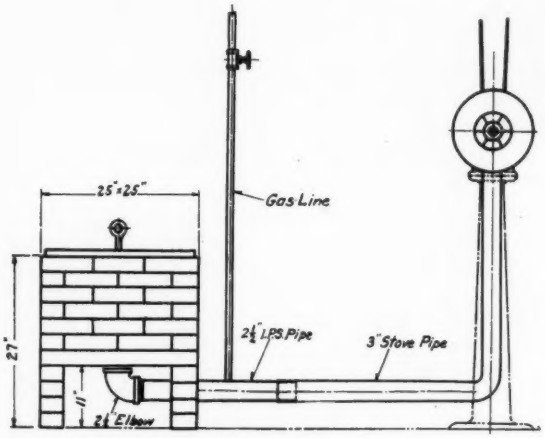
On top of the furnace a piece of cast iron fitted with an eye-bolt for lifting purposes, helps to retain the heat.

Fumes will not result, but care should be taken to have the scrap material free from oil. The burning off of the oil would be likely to cause an unpleasant odor for a short time.

The emery wheel used in this case was run at 1400 R. P. M.

Enough heat was obtained to melt lead, babbitt, aluminum, and brass. The maximum temperature reached was about 2,000° Fahr.

The time consumed in reaching the temperature desired was from 45 minutes to two hours.



ASSEMBLY OF FURNACE.

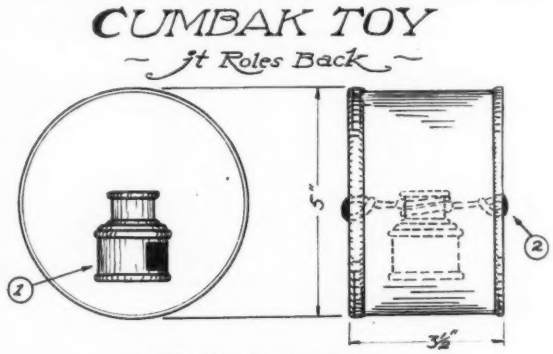
Aluminum and brass castings were made and used in the production of a 1½ horse power gasoline engine.

A furnace built as described could be easily and quickly made and at very little expense to the school district. It would be of great value, if only to melt lead for a demonstration pour, but a great deal more so, if used in pouring babbitt, aluminum or brass to be used on actual production work.

CUMBAK TOY

C. M. Rice, Everett, Washington

The "cumbak" is a very simple project, yet when well decorated it has an excellent appearance. It may be made in the wood-shop or in high-school art classes.



DETAILS OF CUMBAK TOY.

A tin can, such as vacuum packed tea or coffee cans, may be used. A small ink bottle (1) serves as a weight and is held in place by rubber bands, (2) which are fastened to the ends of the can.

"A CLASS PROJECT"

O. T. Turner, Timber Lake, South Dakota

We are in the great open country west of the Missouri River, where there is room for many more people, and it behooves us to advertise the country to get the people.

THE SIGN AS IT APPEARED FROM THE ROAD.

In the fall of 1924, the wagon bridge over the river was completed, and as part of the dedication parade the Commercial Club of Timber Lake suggested a mammoth corn ear. They left the planning and designing of this to the Smith-Hughes agricultural classes of Timber Lake High School.

With the assistance of a carpenter the frame was built of barn bats nailed to five circles, the one at the butt end five feet in diameter, at the tip about 14 inches. The length from butt to tip was eighteen feet. The ear altogether has dimensions about 27 times as great as those of a common corn ear.

The ears were nailed on in rows, one row of ears representing a row of kernels; the ears varying in length from butt to tip.

It took altogether 24 bushels to cover the immense ear. It was then mounted on wagon trucks and hauled to Mobridge where the bridge celebration took place.

In the spring of 1925, it was erected as a monument to the agriculture of this county in the school yard, which is on the Blue and White Trail. Four by six posts were set in cement twelve feet apart the long way and three and one-half feet across. A 2"x8" plank was nailed around this stand and two 1"x12" boards nailed on below this. Thus, a cradle was made in which to lay the ear. This stand was painted blue and white to perform the additional function of marking the trail.

To preserve the ears of corn they were painted yellow and then given a coat of shellac. The whole makes a creditable monument to the Timber Lake Basin and was a fine class project for fifteen boys.

MANTLE CLOCK MAKES GOOD MANUAL TRAINING PROJECT

Chas. A. Dana, Manual Training Instructor, Missoula, Montana

The making of a little mantle clock affords an excellent lathe project. For the works any alarm clock, or the works from some old-fashioned bronze clock, will do very nicely. Since the outside contour of the clock may be made to suit the maker, we will explain only the process of making the hole to receive the works.

A face plate with one screw in the center may be fastened to one side of the block, which is to be the body of the clock. (E, Fig. 1.) Then the hole may be turned nearly through to the face plate. Care must be taken to avoid the screw in the center. This hole should be just large enough to let the works slip in. Next the face plate should be taken off and upon it a wooden chuck made to

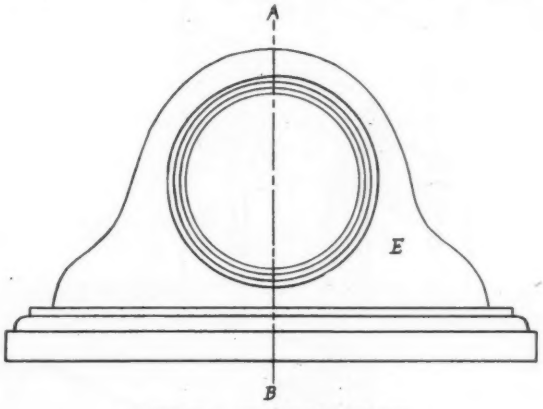


FIGURE 1. DETAILS OF CLOCK.

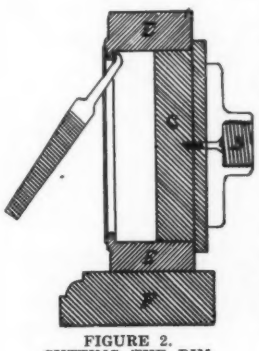


FIGURE 2.
CUTTING THE RIM.

fit tightly into the hole just turned. (C, Fig. 2.) Then the face of the clock may easily be turned and the hole completed to receive the works.

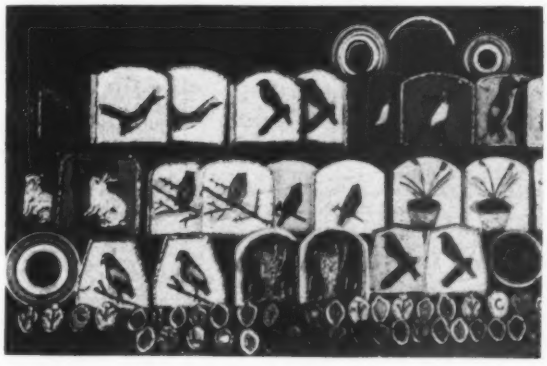
In this way a small rim may be left on the face to keep the works from coming through to the front, and give it a trim appearance. The making of this rim calls for a lathe tool which few shops have. Figure 2 shows how an old wood rasp, or large file, may be bent and used for that purpose.

ATTRACTIVE DESIGNS IN GESSO WORK

In order to lend variety to the manual training and mechanical-drawing course for boys in the ninth and tenth grades of the Park Falls Minn., High School, Mr. L. C. Goss has devised a four weeks' course in gesso work.

Gesso is a composition of six parts of best animal glue covered with water and soaked for twelve hours, four parts of raw oil, and one part of rosin. The glue, rosin, and oil are boiled together in a double boiler. When hot, an equal amount of whiting is added, and the mixture is boiled for ten minutes. Gesso is used while hot. Oil may be used to thin the mixture.

The course this year consisted of making book-ends and a set of six curtain pulls, with designs raised with gesso and colored attractively with bronze colors.



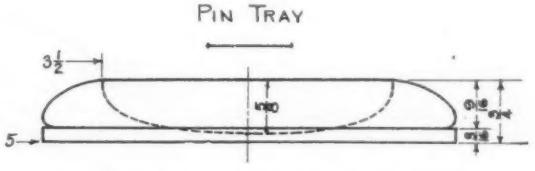
GESSO WORK.

Each boy first made a book-end, six by five inches, using any shape for the top that he desired. Then a piece of tin four inches wide by five inches long was fastened on the bottom at right angles to hold the book-ends upright. Next, each boy designed an individual pattern and transferred it to the book-ends with carbon paper.

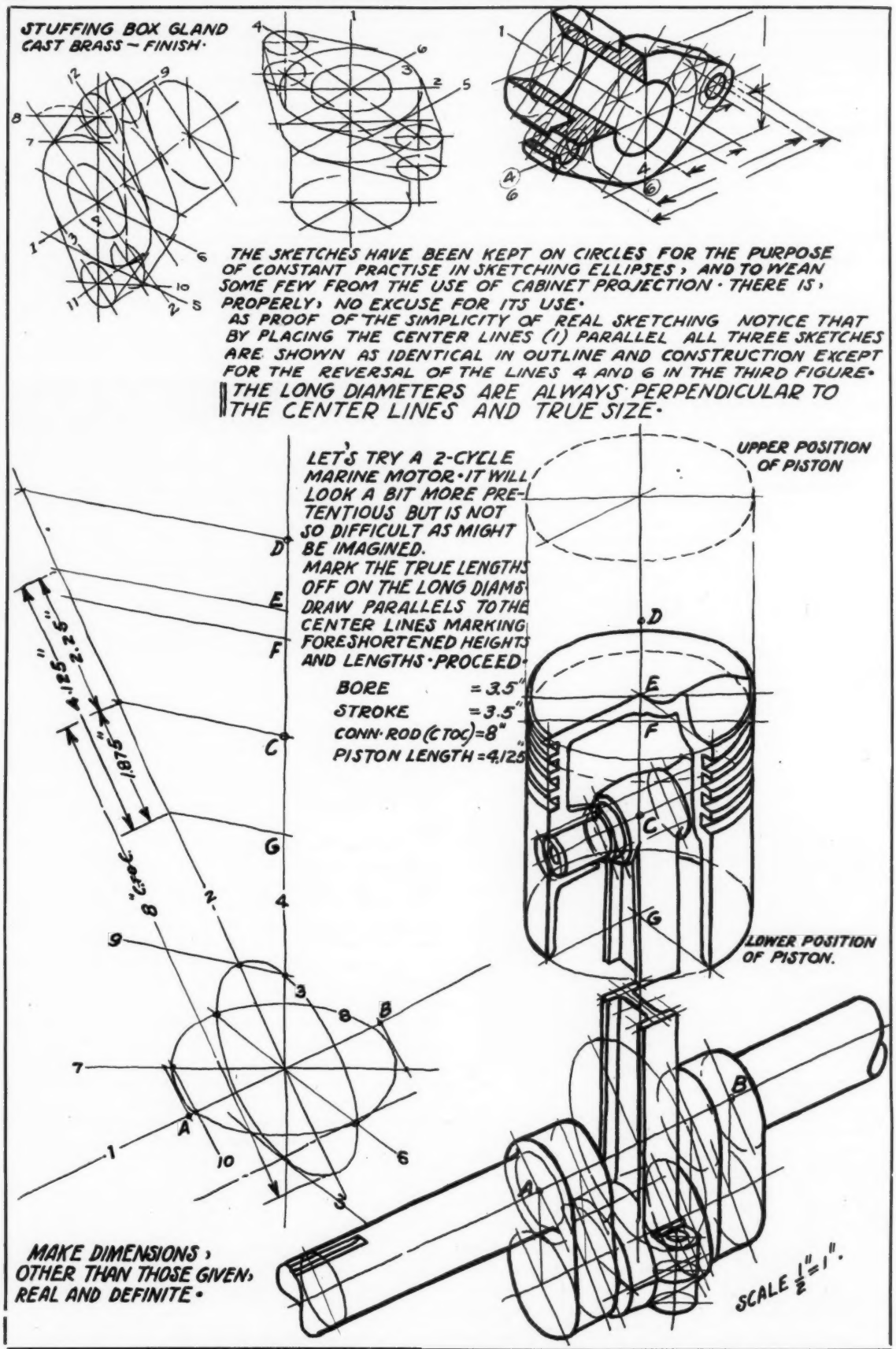
The gesso work was done next. The design was raised with gesso, applied with camel-hair brushes. It must be applied only one-eighth inch in thickness at one time, then allowed to dry, and then raised again and again until the design is completely modeled. This must be done so that the gesso will not crack and chip off.

Next, the bronze painting was done in any colors desired. The picture does not show the variety of colors but it does show the ingenuity and artistic ability of the boys. The tin was painted with black shellac, made by adding lamp black, which makes it a little thicker than ordinary shellac.

The curtain pulls, shown in the foreground of the picture, were made of soft wood, one-fourth inch thick, and were decorated on both sides with small designs raised with gesso and colored. The circular plaques are for teapot or flower-pot stands. Letter files were also decorated.



A TURNED PIN TRAY BY EARL W. ENSINGER.

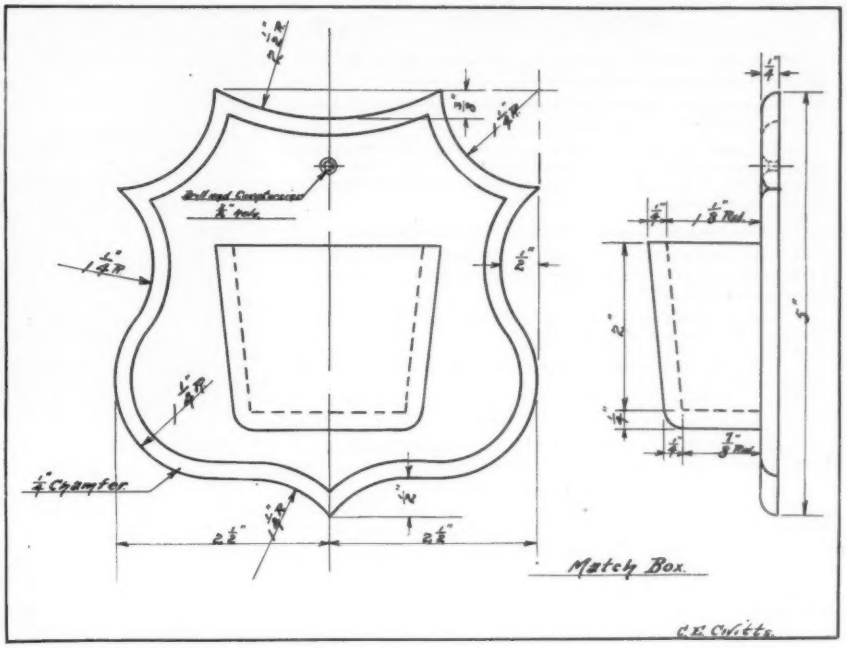

STUFFING BOX GLAND
CAST BRASS — FINISH.
THE SKETCHES HAVE BEEN KEPT ON CIRCLES FOR THE PURPOSE OF CONSTANT PRACTISE IN SKETCHING ELLIPSES, AND TO WEAN SOME FEW FROM THE USE OF CABINET PROJECTION. THERE IS, PROPERLY, NO EXCUSE FOR ITS USE.
AS PROOF OF THE SIMPLICITY OF REAL SKETCHING NOTICE THAT BY PLACING THE CENTER LINES (1) PARALLEL ALL THREE SKETCHES ARE SHOWN AS IDENTICAL IN OUTLINE AND CONSTRUCTION EXCEPT FOR THE REVERSAL OF THE LINES 4 AND 6 IN THE THIRD FIGURE.
THE LONG DIAMETERS ARE ALWAYS PERPENDICULAR TO THE CENTER LINES AND TRUE SIZE.
LET'S TRY A 2-CYCLE MARINE MOTOR. IT WILL LOOK A BIT MORE PRETENTIOUS BUT IS NOT SO DIFFICULT AS MIGHT BE IMAGINED.
MARK THE TRUE LENGTHS OFF ON THE LONG DIAMS. DRAW PARALLELS TO THE CENTER LINES MARKING FORESHORTENED HEIGHTS AND LENGTHS. PROCEED.
BORE = 3.5"
STROKE = 3.5"
CONN. ROD (C TO C) = 8"
PISTON LENGTH = 4.125"
UPPER POSITION OF PISTON
LOWER POSITION OF PISTON.
2.25"
4.125"
1.875"
8" C. TO C.
MAKE DIMENSIONS, OTHER THAN THOSE GIVEN, REAL AND DEFINITE.
SCALE 1/2" = 1".

A SUGGESTIVE PLATE OF PROBLEMS IN TRUE PERSPECTIVE. Prepared by Prof. V. L. Sherman, Lewis Institute, Chicago, Ill. This is the fourth of a series of six helpful plates for teaching true perspective in a simple, direct manner.

MATCH BOX

Clyde E. Civitts, Homestead, Pennsylvania

The match box is a very popular problem among the boys. The shield is made of ¼" stock, cut out with a coping saw, and the edges chamfered ¼" with a knife. The container, which can be made in a variety of different shapes, is carved out of a solid piece of wood, and a quarter inch bottom glued and nailed on. The bottom edge of the container is also chamfered, which conceals the joint and also adds to its appearance.



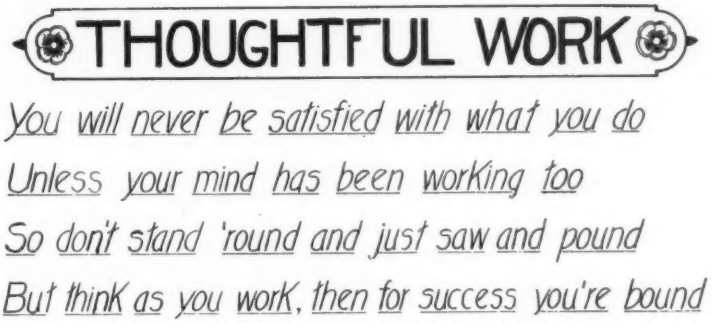
DETAILS OF MATCH BOX.

BELIEVE IN SIGNS?

Jos. J. Lukowitz, Milwaukee, Wis.

Do you believe in signs other than "Keep Off the Grass" or "STOP: Arterial Highway"? If so, read on.

The sign here reproduced graces the walls of the author's shop. The one entitled "Why We Take Manual Training," gives the boys some idea of the purpose of manual training. It helps to answer the cry of modern education—make the pupil feel the need of all of his school work. The six simple reasons are within the easy comprehension of any boy, and the sentiment expressed at the bottom strikes a responsive chord, for are not our boys anxious to do and to accomplish?


THOUGHTFUL WORK
You will never be satisfied with what you do
Unless your mind has been working too
So don't stand 'round and just saw and pound
But think as you work, then for success you're bound

ONE OF THE LETTERED SIGNS BY MR. LUKOWITZ.

"Thoughtful Work" is a gentle but often needed admonishment to work thoughtfully. It has a little jingle which the boys take to, and being written on the plane of the boys' swaggering vocabulary, it serves as an effective reprimand for thoughtless work.

WHY WE TAKE MANUAL TRAINING

1. **It teaches us how to use tools.**
2. **It gives us some idea of industry.**
3. **It gives us a chance to make some useful articles.**
4. **It develops our inventive and constructive ability.**
5. **It develops our appreciation for good form and proportion.**
6. **It inspires in us a sense of achievement—for we show our mastery over material things in a useful way.**

"As Kings of two hands we shall do our part
In every useful toil and art."

RELATED SUBJECTS IN THE PRINTING TRADE SCHOOL—PUNCTUATION

John F. Locke, Department of Vocational Education, Cincinnati, Ohio

The system of modern punctuation is attributed, in the main, to the invention of printing and its growth from infancy has been fostered by ingenious and painstaking typographers. The signs or marks were inherited from the Greek grammarians and in the hands of printers and educators, beginning with Aldus Manutius, have been molded into our present system for pointing off written language.

The old-time apprentice in printing was drilled in the so-called rules for these marks. Today, realizing the importance of this work to typograhy, the apprentice should study these usages and go one step further: Use them with judgment, which comes with knowledge gained both in the school and in the shop.

Punctuation is the art of pointing off written or printed work. Its chief office is to show more clearly the meaning intended. The marks are a somewhat modern invention, as the world read a great deal before they came into existence, nevertheless they are not placed on the printed page merely for decoration.

Marks of punctuation were not used in manuscripts before the year 364 B. C. when a separation mark was placed after each word.

The hyphen (-), period (.), and colon (:) were the first three marks of separation used after the invention of printing. Afterwards a stroke (/) was added to this, but this mark later became what is known as our comma today. Of all the marks that we have, the period is undoubtedly the oldest one that we have, as it appears upon the earliest lettering on stone.

Marks of punctuation are valuable aids to clearness and forcefulness, as they take the place in written speech of the gesture, the pause, and the intonation, with which we supplement our meaning in vocal speech. Wendell says: "Punctuation does for the eye what emphasis does for the ear."

QUOTATION MARKS *Unit 40*

Quotation marks (" ") indicate that the words inclosed by them are the exact language of another person.

A quotation, on the other hand, is the word or words uttered by someone else, introduced into one's discourse.

The usual method of quoting is to use two inverted commas at the beginning of a quotation and two apostrophes at the end. Some latter-day fonts of type, of which Bodoni is one style, have a character especially cast for the first quotation mark.

Some observations regarding the use of quotation marks are:

1. Direct quotations should always be inclosed in quotation marks and should begin with a capital. If they are in the middle of a sentence they should be also set off by commas.

Prof. MacDonald said, "You are doing some nice work here," and later he made other remarks of a similar nature.

Note.—The above sentence is set in Bodoni type in order to show the special quotation marks.

---

7. When words are purposely omitted in a quotation, this omission should be marked by the use of three or four periods.

Mr. Jones says, "Most nouns ending in 'o' form their plural . . ."

8. It often happens that quotations are printed in two parts, the parts, being separated by expressions like *said, asked,* etc. In this case both parts of the quotation are inclosed by quotation marks.

"We must," said Mr. Himmelmann, "enforce discipline in this school."

9. When words or phrases are accompanied by their definitions, they are usually inclosed in quotation marks.

"Drop-folio" means a page-number at the foot of the page.

10. In translation from foreign languages, the English equivalent of a word, phrase or passage is quoted.

Maison, "home," is a French word.

A UNIT INSTRUCTION SHEET (REDUCED).

While the fashion changes in punctuation as in everything else, the tendency at present is to reduce both the amount and the variety, and to hold rather lightly to the so-called rules. In modern display composition, the present-day tendency is to eliminate periods where they appear as terminals of lines. This same idea seems also to prevail with the use of the period after centered headlines, cut-in heads, box heads and after signatures, as well as all lines arranged in either indexed or tabulated form. It is contended by persons of authority and good taste, that punctuation of this kind is detrimental to artistic appearances.

After knowing the uses of the different marks, the best knowledge of punctuation can be obtained by studying the punctuation of good books. A year's experience at typesetting is enough to teach one that sermons, poems, editorials, reports, etc., cannot be punctuated in the same way. While, on the other hand, the punctuation required in the composition of laws and legal work must be very precise, for the incorrect use of a comma or even a hyphen might sometimes give an entirely different meaning than was intended. Because of the fact that different methods of punctuation are required in different forms of printed matter, a study of newspapers, advertisements, catalogs, magazines and commercial work will help in giving any apprentice a clean proof.

MARKS OF PARENTHESIS *Unit 38*

2. To inclose an amount in figures, when it is preceded by the same amount expressed in words.

The amount was one thousand dollars ($1000).

3. Dates are often specified by being inclosed in marks of parenthesis.

(a) During this year (1921) Harding was elected.
(b) Armistice was signed in November (November 11).

4. The date of publication in references should also be placed in marks of parenthesis immediately following the number of the volume and preceding the page number.

The Inland Printer XIV (1912), 63

5. Reference letters or numerals at the bottom of pages are sometimes inclosed in marks of parenthesis, in this connection they are often used singly.

(1) or 1) (a) or a)

6. Letters and figures used to mark divisions in enumerations, run into the text, are also placed between these marks.

The three reasons for his election were:
(1) his popularity, (2) his character, (3) his reputation.

However, if each division is made into a separate paragraph, a single curve is ordinarily used with lower case letters and a period used in connection with capital letters and figures.

A. Under the head of ....
1. Under ....
a) Under ....
b) Under ....

A UNIT INSTRUCTION SHEET (REDUCED IN SIZE).

Unit 127

Lines showing different spacing	Kind of spaces	Fraction of em	Common Denominator
Ioneapieceoften-pointtypeonthefloor.	Solid	.....	.....
I see a piece of ten-point type on the floor.	Hair spaces	.....	.....
I see a piece of ten-point type on the floor.	Five-em	1/5	12/60
I see a piece of ten-point type on the floor.	Four-em	1/4	15/60
I see a piece of ten-point type on the floor	Three-em	1/3	20/60
I see a piece of ten-point type on the floor	2 Five-em	1/5+1/5=2/5	24/60
I see a piece of ten-point type on the floor.	Four-em and five-em	1/4+1/5=9/20	27/60
I see a piece of ten-point type on the floor.	En quad	1/2	30/60
I see a piece of ten-point type on the floor	Three-em and five-em	1/3+1/5=8/15	32/60
I see a piece of ten-point type on the floor	Three-em and four-em	1/3+1/4=7/12	35/60
I see a piece of ten-point type on the floor.	3 Five-em	1/5+1/5+1/5=3/5	36/60
I see a piece of ten-point type on the floor	Four-em and 2 five-em	1/4+1/5+1/5=11/20	39/60
I see a piece of ten-point type on the floor	2 Three-em	1/3+1/3=2/3	40/60
I see a piece of ten-point type on the floor.	Five-em and en quad	1/5+1/2=7/10	42/60
I see a piece of ten-point type on the floor.	Three-em and 2 five-em	1/3+1/5+1/5=11/15	44/60
I see a piece of ten-point type on the floor.	Four-em and en quad	1/4+1/2=3/4	45/60
I see a piece of ten-point type on the floor.	Three-em, four-em and five-em	1/3+1/4+1/5=47/60	47/60
I see a piece of ten-point type on the floor.	4 Five-em	1/5+1/5+1/5+1/5=4/5	48/60
I see a piece of ten-point type on the floor.	Three-em and en quad	1/3+1/2=5/6	50/60
I see a piece of ten-point type on the floor.	Four-em and 3 five-em	1/4+1/5+1/5+1/5=11/20	51/60
I see a piece of ten-point type on the floor.	Five-em and 2 three-em	1/5+1/3+1/3=13/15	52/60
I see a piece of ten-point type on the floor.	En quad and 2 five-em	1/2+1/5+1/5=9/10	54/60
I see a piece of ten-point type on the floor.	Four-em and 2 three-em	1/4+1/3+1/3=11/12	55/60
I see a piece of ten-point type on the floor.	Three-em and 3 five-em	1/3+1/5+1/5+1/5=13/15	56/60
I see a piece of ten-point type on the floor.	Five-em, four-em and en quad	1/5+1/4+1/2=19/20	57/60
I see a piece of ten-point type on the floor.	Three-em, four-em and 2 five-em	1/3+1/4+1/5+1/5=29/30	59/60
I see a piece of ten-point type on the floor.	Em quad		60/60

A UNIT INSTRUCTION SHEET.

The division of sentences by means of marks of punctuation is similar in every way to the division of a book into its chapters, pages, and paragraphs; when done properly a good appearance is produced and clear meaning is aided.

All punctuation marks should be set up and printed in the same style or font of type as the letters or words immediately preceding them.

The principal marks used in punctuation are the following:

Period .....(.)
Interrogation mark.....(?)
Exclamation mark.....(!)
Semicolon .....(;)
Colon .....(:)
Comma .....(,)
Brackets .....([ ])
Marks of Parenthesis.....(( ))
Dash .....(—)
Quotation marks.....(" ")

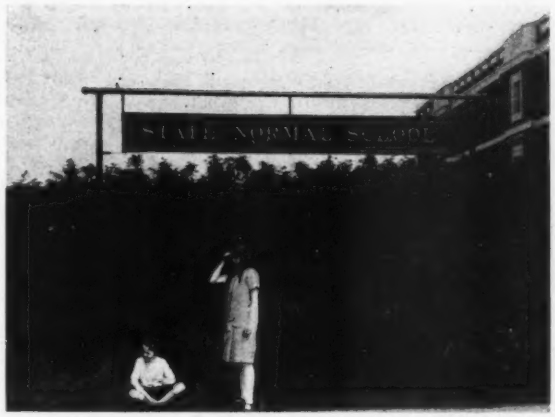
The apostrophe and the hyphen, while classed with the other marks, are more closely related to spelling than to punctuation, but like spelling both are the subject of many mistakes.

Punctuation is one of the most important parts of the course in English for printing apprentices. In fact, it is one of his working tools, just as the dictionary is a friend of good standing. The course should be taken up by a thorough study of each one of the marks, correlating it with proofreading and exemplifying it (enough to give it a trade emphasis) by sentences pertaining to printing. By giving proofreading throughout the course, in carefully graded sheets embodying first the use of one mark and increasing the number of marks per sheet until all are being used, there is a constant drill, not only in punctuation, but in division of words, capitalization, etc. Other means of stimulating the interest of the student in this important part of his apprentice training is accomplished by the writing of business letters, orders, bills, and letters of application.

A GOLD LEAF SIGN

Joseph C. Park and Wadsor M. Scoville, Oswego, N. Y., State Normal and Training School

A beautiful new gold leaf sign—"State Normal School"—has been erected at the southwest corner of the campus of the Oswego State Normal School by the *force*



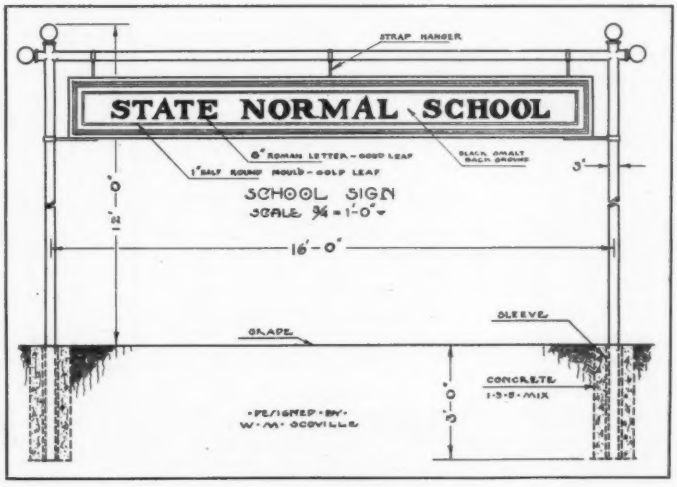
THE SIGN IN PLACE.

of the school. By force of the school we mean (a) efforts of principal and instructors, (b) efforts of various skilled students who have been trained here, and (c) minimum but necessary outside help to expedite the work in plumbing and concrete. This sign was built by the students under the direction and help of Mr. Scoville of the architectural drawing department. The woodworking on the sign was done by the students in the woodshop under the direction of Mr. Jorgenson. The wood letters used in the sign were purchased from a manufacturer of wood letters.

For those who may be interested in getting helps in constructing a similar sign we submit the accompanying drawing and halftone together with the following specifications:

The sign is built of 1⅛" pine 14" wide by 14' long with a 1⅛" back band. The letters are known in the trade as 8" extended Roman sign letters. The finish consists of three body coats of lead and oil with one coat of outside black finished with black smalt. The letters received the same body coats with one coat of yellow and one coat of gold size. They were then finished with gold leaf and two coats of spar varnish. The sign is supported twelve feet above the grade on a 3" galvanized iron pipe frame painted black.

The sign was dedicated on Arbor Day, 1925, with appropriate exercises. Mr. Thomas Hogan, president of the Industrial Teachers' Club, made the dedicatory address.



DETAILS OF SIGN.

ERRORS IN HAND WORK

Chas. A. King, State Normal School, Plymouth, N. H.

The students of the author in the series of photographs of "Errors in Hand Work," illustrated on page 428, were intensely interested in discovering errors in position and in tool usage therein contained. After they had seen their errors, or in other words, had "Seen themselves as others see them," a new attitude of definite interest was apparent throughout the class. This method of showing the common errors in the use of tools evidently aroused their interest, and it was plain they observed themselves and each other keenly, all profiting thereby.

The photographs illustrate the fact that when tools are used properly there is that grace, ease of position and motion, and freedom from awkwardness always apparent in the attitudes and motions of the skilled workman, who by long practice has made his tools almost "extended hands." Also, the photographs seem to emphasize the fact that there is less than the highest efficiency in the use of tools, when an observer senses awkwardness in either position, or the application of force to the tools.

A written exercise in which each student records the result of his study of each photograph affords an excellent opportunity for him to express his knowledge of the use of tools, and at the same time, allows the teacher to check the reaction of different individuals to his instructions.

In the caption accompanying each photograph will be indicated the number of errors in both body position and tool usage illustrated. The former includes errors in position of feet, head and arms as well as of the body itself. Errors of position of hands and of the manipulation of tools are considered separately.

USE OF THE BACK SAW (FIG. 1)

Key—The body position and the use of the tool are both essentially correct, excepting that the head should incline a little toward the right to bring the eyes in line with the cut.

USING THE BLOCK PLANE (FIG. 2)

Key—Errors in Position

1—Standing in front of work instead of behind it.
2—Feet not braced to resist the application of necessary force.
3—Right shoulder not in position for effective work.
4—Right forearm not in position for application of force in line of cut.
5—Position of body, shoulder especially, indicates lack of force.

Errors in Use of Tool

1—Block plane not carried at efficient angle.
2—Left hand between side of plane and work.
3—Right hand grasping plane too loosely.

USE OF THE RIP SAW (FIG. 3)

Key—Errors in Position

1—Body too far from the cut.
2—Body at right angle with the line of the cut.
3—Right leg not in position to support the body properly.
4—Right forearm not in line with cut.
5—Right shoulder should be in line with cut to permit an easy swinging motion of the entire arm.

Errors in Use of Tool

1—Both hands are grasping the saw handle.
2—The left hand should rest on the board and support the shoulder.
3—Saw carried too nearly horizontal to cut effectively.

USE OF THE BLOCK PLANE (FIG. 4)

Key—Errors in Position

1—Right arm should swing nearly vertical from shoulder.
2—The body should be at an angle of about 45 degrees with the work.

Errors in Use of Tool

1—Plane is carried at too great an angle with the surfaces of the board; difficult to control the accuracy of the end being planed.
2—Direction of stroke of the plane is in line with the position of the plane instead of being parallel with the surfaces of the board being planed; results in tearing splinters from face side.

PERSONAL NEWS

Mr. F. L. Bouda, a recent graduate of Stout Institute, has accepted a position as director of industrial arts at Minot, N. D.

Mr. Carl Gavic, a former student of Stout Institute, is teaching woodwork at Detroit, Mich.

Mr. John Maerzke, also a former student of Stout Institute, is now located at Springfield, Mass.

Mr. James Relihan, formerly of Stout Institute, is teaching manual training in the junior high school at Tampa, Fla.

Mr. Orley L. Duffin is teaching at Oskaloosa, Ia.

NOW, ARE THERE ANY QUESTIONS?

A Walnut Finish

Q. 535. I have finished a console cabinet of solid walnut, except doors which have a thin veneer of figured walnut, and would appreciate very much some information about a good stain for walnut.

I have used commercial stains on walnut, but do not get the beautiful finish or results that fine walnut furniture has. I wish to produce a rich brown finish (not too dark) and want a stain that will not affect a veneered surface. On the doors I wish to have a two-toned finish. I am using Pratt and Lambert's cabinet finish.—R. J.

In regard to staining the console a walnut, apply a coat of Universal Brown Water Stain No. 200, (as made by Waring-Bowermann Finish Products Co., Syracuse, N. Y.) using a wide, soft-haired, rubber-set brush. Let dry thoroughly; which, in this case, would be from five to six hours. The two-toned part is then given a second coat of the same four ounce color.

In the case of the veneered door, the usual treatment calls for the application of the stain, two or three minutes to set, and the wiping off of the remainder with a clean piece of cloth to prevent the glue beneath the veneer from absorbing the moisture from the water stain. This must be done carefully in order to prevent any difference of shade in the rest of the work. Before applying the second coat of water stain, the veneer should be very carefully dried, in order that the glue may not absorb any moisture and cause the veneer to blister. If this be done very carefully, using the stain thoroughly, it may not be necessary to wipe the work with a cloth. As a usual thing, this particular class of staining is done only by specialty men who are the highest paid in their class.

Allow at least twelve hours drying of the water stain.

The whole piece should then be given a sizing coat of one part orange shellac, reduced with two parts denatured alcohol. This will enable the color to be judged, and any touching up work necessary can then be done. By dissolving Bismarck Brown Y in alcohol to make a saturated solution and Nigrosine A. S., these two solutions of red and black may be added to the shellac solution, to produce any possible shade of brown. The touch up work may be done with a soft Fitch brush as wide as is convenient, although in the factory in the hands of expert operators practically nothing but the air brush is used. For instance, by shading the orange shellac, reduced one part with alcohol, to a deep brown, the two-toned work can be very strongly emphasized. All shellac work should be dried hard, generally from three to five hours at 75° F. and may then be sanded with a split 6-0 garnet paper.

A deep chocolate-brown silex filler should now be applied, carefully padded into the pores, and thoroughly cleaned out of all cracks and corners. Twenty-four to 48 hours should then be allowed for drying before brushing on a thin coat of Pratt & Lambert's No. 61 varnish, which as I have found, is much more durable and yet rubs perfectly when compared to P. & L.'s cabinet varnish which you are using.

The first coat of varnish should dry about five days, and should then be sanded very carefully with a split 6-0 garnet paper. The work should then be dusted off and given a full flowing coat of P. & L.'s No. 61 varnish, laying it on heavy enough so as to just avoid sags or curtains. The ideal brush for this work is a full chisel, two-inch Fitch brush.

The last coat of varnish can be water sanded with an 8-0 Minnesota Mining Co. "wet or dry" finishing paper. If this is done correctly, the surface will be completely levelled off, all nibs cut down, so that if necessary, a third coat of varnish can then be applied in case of thin spots in the varnish. If after chamoising off from the water sanding, the surface proves to be plump and true, the rubbing may then be completed by using a quarter-inch pad, crude oil, and FFF pumice stone. With a light rubbing of this material, the thin satiny finish, now popular with walnut, can be produced, but great care must be exercised in order to prevent rubbing through. This will approximate the very thin, transparent, lacquer finish which the furniture factories are producing.—Ralph G. Waring.

Substitutes for Walnut and Mahogany

Q. 534. Please inform me what woods are best to use as substitutes for walnut and mahogany when you wish to construct a piece and do not wish to make it solid walnut or mahogany on account of the expense.

I have been unable to get silex powder for filler and dry stains, such as you recommended in your answers, through local hardware stores. Will you please inform where I can send for these supplies without much delay?—H. E. P.

A: I have found that basswood and cherry make first rate substitutes for walnut and mahogany where birch can not be obtained. This latter makes a good imitation of both when treated with a water stain. Furniture factories are also using large quantities of butternut to replace walnut. In such members as legs and cross rails, where strength and resistance are required, cherry is undoubtedly the best material. Stains and similar materials can be obtained from this Company (Waring-Bowerman Finish Products Co., Inc., 1648 Valley Drive, Syracuse, N. Y.) on receipt of the desired information as to quantity and material.—Ralph G. Waring.

Wanted: An Ice Box Design

Q. 549. I am desirous of obtaining details of the design and construction for making an ice box to be used on an automobile for picnics, camping, etc. Can you tell me where I can obtain such plans?—E. M.

A.: Can any contributor to the INDUSTRIAL-ARTS MAGAZINE supply us with a drawing of a successful ice box which can be published to satisfy the needs of this inquiry?

PERSONAL NEWS

George A. Pelican of Ann Arbor, Mich., has been appointed director of art in the Milwaukee, Wis., schools, to succeed Mrs. Emily Dorn Pearse.

Mr. R. L. Evans has been appointed head of the vocational and continuation school at Sheboygan, Wis., to succeed C. H. Johnson.

Mr. C. G. Holbrook has been appointed head of the printing department at Boise, Ida., to succeed J. E. Hutchison, who has been given a leave of absence.

Mr. E. M. Hemmerly, for the past two years instructor in manual training in the high school, Bridgeport, Pa., has resigned to accept a position in the Philadelphia schools.

Mrs. Marjorie B. Wadsworth has been selected as art instructor at Bridgeport, Pa.

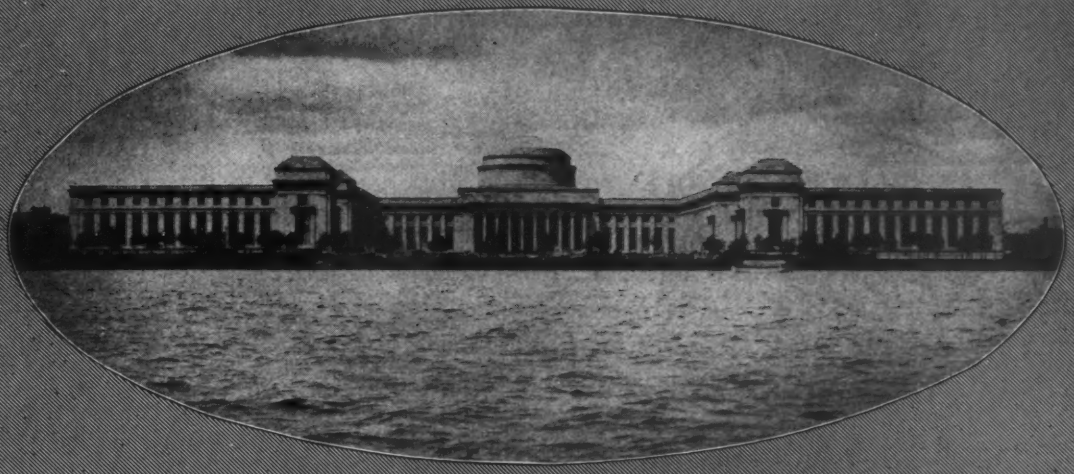
Mr. C. G. Bertram, of Marion, Wis., has been employed by the vocational school board of Fond du Lac, Wis., to teach academic work in the vocational school. Mr. Bertram is a graduate of the industrial department of the Oshkosh Normal School, and has had considerable teaching experience.

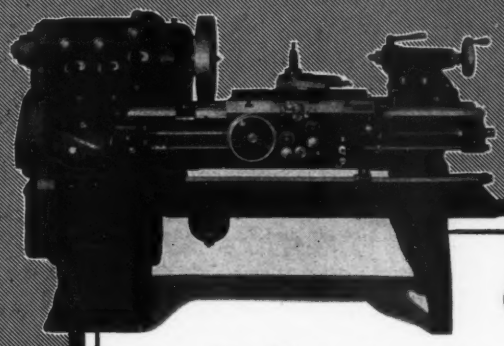
Mr. Arthur C. Jewett, formerly on the faculty of the University of Maine, has been appointed director of the College of Industries of Carnegie Institute of Technology at Pittsburgh, Pa. Mr. Jewett is a graduate of the Massachusetts Institute of Technology and has had experience in engineering work.

Miss Allene Bell of Pigeon Creek, Ala., has been appointed as itinerant teacher-trainer in home economics work for Alabama. This work is conducted jointly by the Alabama College and the state board of education. Miss Bell was for the last two years in charge of the home economics departments in the Montevallo high school.

Mr. J. R. Fuller has been employed as director of the Alabama School of Trades and Industries at East Gadsden, Ala. Mr. Fuller was formerly principal of the Agricultural Training School for Disabled Service Men at Greensboro, and was at one time engaged in trade school work in Kansas and Texas.

Mr. L. D. Patterson has been appointed head of the fine arts department of the Northern Normal and Industrial School at Aberdeen, S. D. Mr. Patterson is a graduate of the Cumming School of Art, and of the University of Iowa, and holds degrees from both Iowa University and Harvard University. He also completed a year's work at the Pennsylvania Museum and School of Industrial Art at Philadelphia. Mr. Patterson has filled positions in the art departments of the state universities of Iowa and Wisconsin, and for the last three years has had charge of the freehand drawing department in architecture at the University of Illinois.





and now—

The Massachusetts Institute of Technology uses The

MONARCH Helical Geared Ball Bearing LATHE

as a part of their Metal Working Equipment.

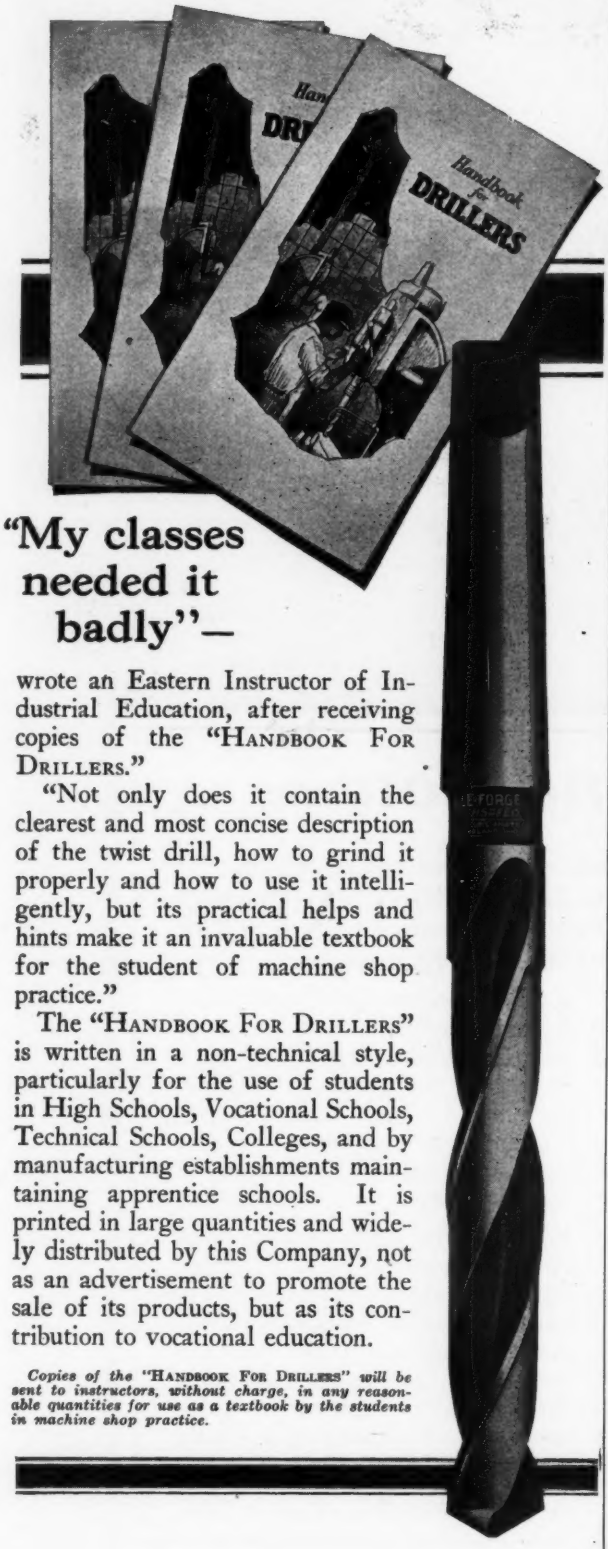
The prestige of this Institute—the corner-stone of Massachusetts' enviable system of vocational education — attracts students from the four corners of the civilized world.

In choosing the equipment for these students, the directors of the Institute must base their choice upon equipment that will give students the greatest possible amount of experience.

We are proud of the selection of the MONARCH Engine Lathe as a part of the Institution's metal working equipment — proud that it has been selected solely upon its merit, after careful consideration, as the type of equipment necessary for the high degree of training which Massachusetts "Tech" gives to its students—a training which has been so creditably reflected on the Institution by its graduates.

We shall be glad to plan your vocational metal working shop. Give us a statement of your requirements and let our Free Engineering Advisory Service plan your shop, giving you an accurate estimate of the entire equipment cost. This service is gladly rendered without charge.

THE MONARCH MACHINE TOOL COMPANY, 404 OAK STREET, SIDNEY, OHIO.



"My classes needed it badly"—

wrote an Eastern Instructor of Industrial Education, after receiving copies of the "HANDBOOK FOR DRILLERS."

"Not only does it contain the clearest and most concise description of the twist drill, how to grind it properly and how to use it intelligently, but its practical helps and hints make it an invaluable textbook for the student of machine shop practice."

The "HANDBOOK FOR DRILLERS" is written in a non-technical style, particularly for the use of students in High Schools, Vocational Schools, Technical Schools, Colleges, and by manufacturing establishments maintaining apprentice schools. It is printed in large quantities and widely distributed by this Company, not as an advertisement to promote the sale of its products, but as its contribution to vocational education.

Copies of the "HANDBOOK FOR DRILLERS" will be sent to instructors, without charge, in any reasonable quantities for use as a textbook by the students in machine shop practice.

The CLEVELAND TWIST DRILL COMPANY CLEVELAND NEW YORK-CHICAGO-LONDON

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NEW BOOKS

Elementary Mechanical Drawing

By C. W. Weick, revised by F. C. Pannska. Cloth, 251 pages. Price, $2.000. The McGraw Hill Book Co., New York, N. Y.

This is a thoroughly revised edition of a popular work issued about ten years ago. While the scope and method of the book have been retained exactly, considerable improvement has been made in presenting orthographic projection. A new chapter on sketching has been introduced. The most radical improvement has come in the plates suggested for practice. These omit mere exercise plates and include new problems applied to furniture making, forging, applying principles to objects with which the student is familiar and to which he can apply his knowledge of drawing in the shop. The chapters on mathematics are left unchanged. Throughout the book numerous minor additions, based on new methods and conventions, have been introduced.

A Guide to the Study of Woodworking

Paul V. Woolley. Cloth, 61 pages. Price, 90 cents. Manual Arts Press, Peoria, Ill.

This book is a comprehensive reference index to American books on woodworking. In alphabetical form, it lists a remarkably inclusive number of subjects concerning which students and teachers desire information. The book will be useful in every school where wood-working is taught.

Problems in Home Economics Teaching

Leona F. Bowman. Cloth, 146 pages. The University of Chicago Press, Chicago, Ill.

Sixty-seven typical problems in organizing and conducting home economics classes are here stated. Leading questions indicating possible solutions and references are given for guidance. The book covers a very broad field—the aims and obectives of the work; subject matter; typical classes of projects; problems in teaching, (a) food and nutrition, (b) clothing and textiles, (c) home management, (d) child care; aids and methods of teaching; time organization; courses of study; the laboratory, its equipment and arrangement; the qualifications of teachers; administrative and community problems. A few of the problems discussed rather extend beyond home economics as such, and can't be solved by considering the home economics or school phases only. A very few of the references do not appeal to us.

Job Sheets in Practical Woodwork

Arthur G. Brown and F. E. Tustison. 31 sheets. 8"x11". Price, 56 cents. The Bruce Publishing Company, Milwaukee, Wis.

The job sheet, as a device for class instruction, has made a place for itself partly because the activities in the average shop are so numerous that no one instructor can properly handle the class and give each member the individual attention which he deserves, and in part because it is a logical part of well defined shop lesson plans.

The present set of sheets afford a fundamental course in woodwork for beginners, particularly for boys in the seventh and eighth grades. The sheets carry along simultaneously and in logical order all of the essential woodworking processes which every boy must acquire in any fundamental course, information on materials and tools and the care of tools, and a series of useful projects which the boy can use in the home and in the home shop.

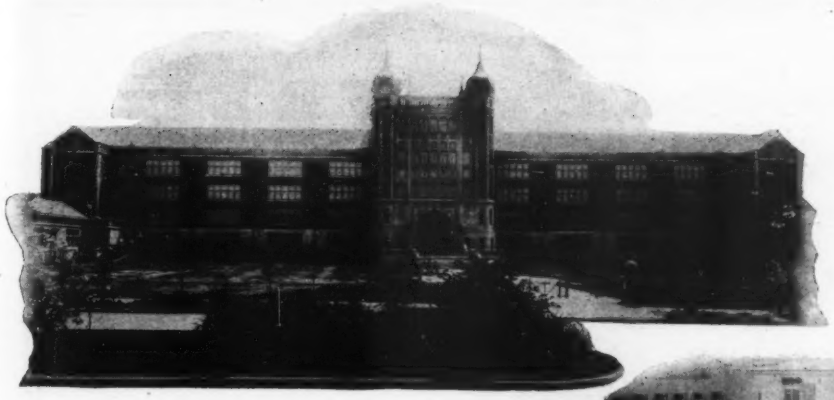
The sheets set a new standard for completeness, for clarity of illustrations, and for general scope. Opportunity is afforded wherever possible for a variation in the jobs so that the boy who may not care to make, say, a hat and coat rack, may carry on as an alternating problem in the making of one or two other articles involving identically the same principles and tool processes. The sheets have been tried out extensively by the authors in their classes, and give evidence of practical use in the school shop.

Manual of Hand Woodworking

By DeWitt Hunt. Cloth, 8 mo. Price, $1.25. Harlow Publishing Co., Oklahoma City, Okla.

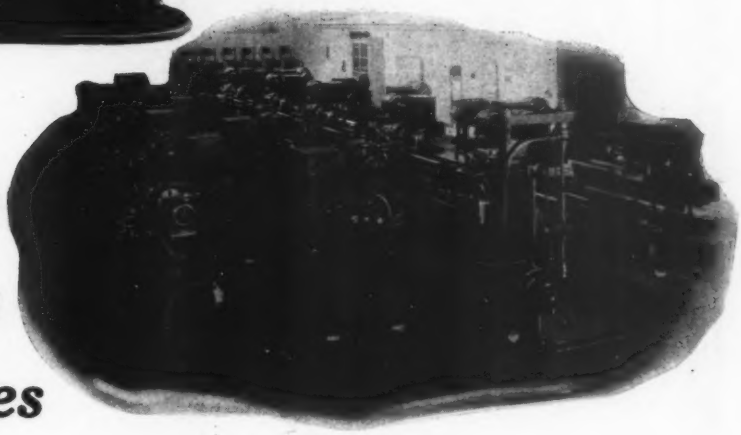
The fundamental processes, tools, and materials used in woodworking are outlined for beginners in 36 brief chapters. A series of simple projects is woven into the chapters to illustrate principles and operations. The book is very completely illustrated.

Mr. Leo Goulet, of Ontonagon, Mich., has been appointed director of manual training at Osceola, to succeed Peter Peterson.



Roosevelt High School, St. Louis, Mo.

and a corner of the Manual Training Dept. showing eighteen 14"x6' and two 18"x8' Sidney Medium Pattern, Motor Driven Lathes.



Being "From Missouri" has Its Advantages

—especially for the boys taking shop and tool room practice at Roosevelt High School, St. Louis.

When it came to selecting equipment for this school, the Board of Education was likewise "from Missouri," which accounts for the fact that nothing but the best in modern shop equipment was selected. Included in this equipment are twenty Sidney Medium Pattern Motor Driven Lathes.

You may be located in any state in the Union, but when it comes to the selection of your Manual Training Equipment, just remember that it pays to be "from Missouri."

Your easiest—and safest—step is to write for a copy of our new catalog which will soon be ready. Meanwhile, if you want any help in laying out your Manual Training Department, our Engineering Department is at your disposal, entirely without obligation. Simply mark your letter for attention of Dept. 410.

The Sidney Machine Tool Co.

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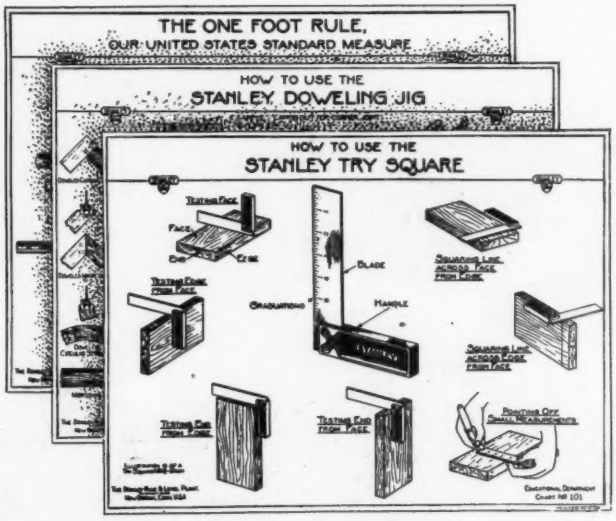

Note:—There are two more in this series—
Chart No. 102 on the Stanley Doweling Jig
and Chart No. 100 on Stanley Rules.

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Measures 17 x 12 3/8 inches. Very helpful in classroom work. Can be framed under glass if desired. Copies will be gladly supplied without charge.

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NEWS AND NOTES

Adopt Evening Trade Program. The city board of education of Montgomery, Ala., has adopted an evening trade instruction program for the present season. An appropriation has been made for the work, to be under the direction of a part-time supervisor. The program embraces such work as mechanical drawing, shop mathematics and blue print reading for the metal trades; blue print reading, estimating, and the use of the steel square for carpenters. It is the purpose of the board to meet the school needs of tradesmen of the city who are ambitious to learn more about their work.

Study Responsibilities of Home Economics Teachers. The Federal Board for Vocational Education recently appointed a national committee to plan and conduct a study on "Responsibilities of the Day School Home Economics Teacher." The purpose of the work is to find out the responsibilities of such teachers, the difficulties of teachers in meeting their responsibilities, means of improving training courses, and how to make supervisors of more service to teachers. One member was appointed to represent each section of the country, namely, pacific region, central region, southern and Atlantic regions. The first meeting was held at Buffalo, N. Y.

School of Trades Opened. The citizens of Gadsden, Ala., recently gave a barbecue on the occasion of the dedication of the Brown dormitory, the first of a series of buildings constructed to house the Alabama School of Trades and Industries. The school is located in East Gadsden, and sessions began on September 14th. Mr. L. R. Fuller, of Greensboro, Ala., has been employed as director.

Illinois Association Meets. The next meeting of the Illinois Manual Arts Association will be held at the University of Illinois, in connection with the annual high school conference.

Offer Evening Printing Course. The New York Evening High School. of the Washington Irving High School, offers a special course of evening instruction in advertising typography, preparation of copy, proofreading, and cost estimating. The purpose of the course is to teach accurate typography, to study the details of proofreading and copy-preparation, and the elements of cost-finding and estimating.

Master Painters and Decorators Meet. A meeting of master painters and members of state and city boards of education of Connecticut was held at Hartford, on September 9th, to discuss plans for a part-time vocational school for painters, to be opened this fall. The local board of education has agreed to cooperate with the master painters' association in the organization and conduct of the school.

Offer Two-Year Vocational Courses. Two-year vocational courses are being offered at the Academy and East High Schools, Erie, Pa., this fall. The classes are open to boys 14 years old and over who have completed the eighth grade. The subects offered at the Academy include drafting, machine shop practice, sheet metal work, electrical construction, cabinet making, pattern making and printing. At East High School, the subjects are drafting, machine shop practice, automobile mechanics, plumbing and tailoring.

Open Placement Bureau. A vocational guidance and placement bureau has been opened at Newark, N. J., in connection with the Essex County Vocational School. The bureau is in charge of Miss Rosa Galaida, and will serve the entire junior population of the county.

The bureau will not be a recruiting station for the industries but is intended to be of direct help to boys and girls in making use of their abilities. A wealth of information will be gathered relative to fields in which there are desirable openings, in contrast to the blind alley jobs into which children stumble when guidance is lacking.

Offer Interior Decorating Course. One of the recent additions to the vocational courses offered at Los Angeles, Calif., is the practical arts school for the interior decorating trades. Mr. A. Baroggio is director of the school.

Gift of Vocational School. A vocational school, to be erected this fall at Reinhardt College, Waleska, Ga., is the gift of Samuel C. Dobbs, of Atlanta, a great believer in the school and its work. The building will be known as the Samuel C. Dobbs Vocational School, and will cost approximately $100,000.

(Continued on Page 27a)

(Continued from Page 24a)

In connection with scientific farming courses to be taught in the new building, the boys will receive practical experience on model farms owned by the College, and in poultry, animal husbandry and allied departments. Each boy will be required to carry out a practical project under the supervision of the vocational teacher. This will begin with field crops, and end with farm management the fourth year, thus equipping the boys for better and scientific farming.

Vocational Courses Offered. The Essex County Vocational School at Newark, N. J., opened with courses in automobile mechanics, carpentry, drafting, electrical and machine shop practice. The courses are three years in length and sessions will be continued through July, 1926.

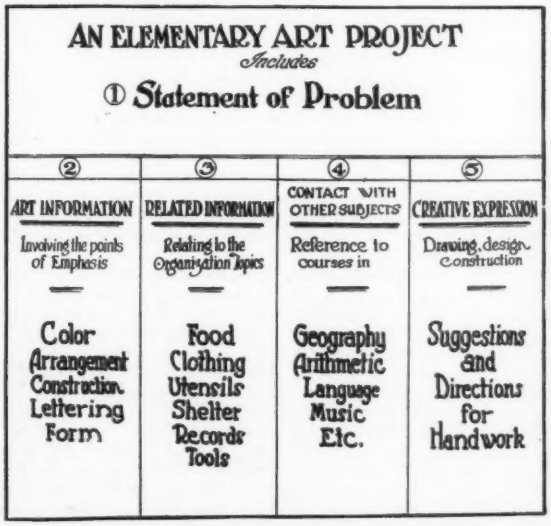
Student Sues Board for Injuries. The loss of a hand crushed in a printing press in the manual training department of the Hall Township Vocational School, Spring Valley, Ill., has been made the basis of a $10,000 damage suit against the board of education and the instructor, by William Terasavich who was injured on September 23, 1924. A charge of negligence was made against the school management by the boy's father on the basis that the boy did not receive proper instruction before being permitted to operate the press, and that he was not warned as to the danger.

Domestic Science Department. A domestic science department has been added to the school system at Dayton, Ky. Opportunity is offered to every girl from the seventh to the twelfth grades in learning to sew and cook. A cafeteria department has been added and is conducted by the domestic science department, aided by the mothers' club.

A Vocational School. Camden County, N. J., will have a vocational school. The Camden Currier in discussing the project says: "One fact about vocational schools for boys that may put them ahead with a good many parents is that **they don't teach evolution.** This is half a joke, and half serious. The bigger half is the serious one. It is just an exaggerated way of bringing out the practical nature of industrial training. The boy in the vocational school is learning things that will help him make his living.

New Art Curriculum. An art curriculum for the elementary schools of Baltimore, Md., has recently been prepared as a means of promoting training in taste, the cultivation of artistic judgment, and the development of the capacity to enjoy the beauty of products of fine quality and design.

The course outline takes the form of a series of projects involving the solving of problems, using as a background of related information, the courses of study in history, geography, English, etc., now in use in the schools. The content material relates closely to the industries useful to man, the products of which are grouped under the headings of food, shelter, clothing, utensils, tools, machines and records.



A TYPICAL CHART IN THE NEW BALTIMORE ART CURRICULUM.

GOLD MEDAL CRAYONS · FOR EVERY USE ·

Industrial Arts and School Festivals

INCREASINGLY, the industrial arts classes assist in other school and community activities. For group festivals, color in the background setting is an important feature.

The value of GOLD MEDAL Colored Chalk Crayons and Lecturers' Colored Chalks is unquestioned. They are so easy to apply, and call for no technical mastery.

The colors are riotous in brilliancy when used directly; when blended on either paper or cloth they become subdued though always vibrant.

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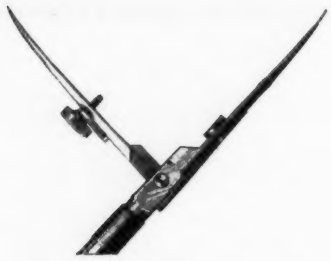
Makers of the best-known Crayons in the world



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A Sphinx Jack-Knife Ruling Pen filled with Weber Waterproof Drawing Ink—that's a combination you can always bank on for precise clean-cut drawings and blue prints.

The Sphinx Jack-Knife, like all Weber-Riefler ruling pens, is made of selected, heat-hardened steel, with nibs ground by special process. It will draw the finest lines with absolute uniformity — now and ten years from now—for the jack-knife principle will encourage your pupils to keep it spotlessly clean.

Weber Waterproof Drawing Ink is free-flowing, non-corrosive and opaque. It can not harm the pen and it is easy to work with. Its sharp, clean cut, jet black lines on the drawing insure sharp, clean cut impressions on the blue print.

Recommend using them together—Sphinx Jack-Knife Pen and Weber Waterproof Ink—they'll soon draw their own conclusion of satisfactory results.

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Drawing Instruments & Materials

A large fund of related industrial information is provided, but the emphasis is placed on the art side of the projects, rather than on the related subject matter. Wide scope for handwork has been provided for, with suggestions of appropriate problems, together with the necessary general directions for solving them.

Under the plan to be followed, the art period will become a combined industry-drawing-construction appreciation period. A proper use of the project method of instruction will result in art work becoming a part of all other school subjects.

Stout Institute Enrollment. The enrollment of students at Stout Institute has reached a total of 224, which is a considerable increase over any high mark in former years.

Working Children Not Required to Attend School. School children released from classes at the age of 16 because of work permits are not required to attend the part-time school about to be established at East Liverpool, O. This opinion was given by the board of education following a discussion as to whether such children would be required to attend school until 18 years. Under the law, they must enroll in some business college or other private institution in order to gain exemption.

Boys Construct Machine. The machine shop students of the vocational school, Wausau, Wis., have constructed a machine for the building of rolls used in the sandpaper industry. It consists of a casting and wrought steel construction which fit together within one-thousandth of an inch, and is entirely practical in character. In working upon the machine, the boys were given valuable practice in mathematics in connection with machine work.

Open First Teacher Center. The first vocational teacher center of the year has been opened by the bureau of industrial teacher training of the University of Texas Extension Division at Austin. Other centers are to be opened at Port Arthur, Houston, and El Paso. Upon the completion of the course offered by the bureau, a state vocational certificate is awarded the student. The bureau of industrial teacher training has had an active part in the development of the vocational programs in the state and the majority of the teacher trainers at work in the state the last year were trained by the bureau.

Large Number of Students Enroll. The initial enrollment of students at the vocational school, Fond du Lac, Wis., totaled 226. Of the students enrolled, 68 signed up for the home economics work, 100 for shopwork, and 58 for the commercial courses.

Will Do Practice Teaching. Stout Institute of Menomonie, Wisconsin, and Dunwoody Institute of Minneapolis, Minnesota, have entered a cooperative arrangement by which ten teachers from the special vocational group at Stout will do practice teaching at Dunwoody. The latter institution has especially heavy enrollment from November to April and additional classes are organized during this period. The Stout men, who require practice teaching as a portion of their training, will handle some of the overflow classes at Dunwoody.

Laporte, Ind. The board of education has opened an ungraded room for academic and industrial work for backward children. Mrs. Susan Kirk has been employed as instructor of the classes.

Newark Museum Has Exhibit of French Art. The Newark Museum Association of Newark, N. J., has made arrangements with French agents, through which it plans to hold a representative exhibit of modern French decorative art for the benefit of American industries. The exhibit will stress that phase of the art based on machine production in the belief that it will assist the entire international field of decorative art, and that through machine production America's problems in decorative art will find their solution.

The Newark Museum was the first museum in the United States to preach the doctrine that a museum should be useful to the industries, and it has from the first dedicated itself to the task of stimulating the production of American styles and designs.

Hold Short Course in Kiln Drying. Three men from the Pacific Coast, one from Alabama, one from Colorado, five from Pennsylvania, one from New York, one from Iowa, and two from Michigan, a total of fourteen, attended the instructional short course in kiln drying of lumber given at the U. S. Forest Products Laboratory, Madison, Wis., from September 21st to October 2nd. This class brought the total enrollment for laboratory drying courses

(Continued on Page 30a)

Something New — and Better — Painting Plaques with "Reliefo"

A plaque, a good print, some paste, a jar of "Reliefo," a large flat surface painting brush, stiff stipple brush and a bronze color - these are the tools for "Reliefo" plaque work. If the print you are mounting is a satisfying one, you will become tremendously enthusiastic over the success of your undertaking.

Our American Art Aid Department has many similar suggestions for you along this line. The fascinating ways in which this wonderful relief paint, "Reliefo," can be used are legion. With "Reliefo," you know, you can obtain color and relief effects with but one application. Many industrial art classes have standardized on this ideal medium. It is furnished in the following colors:

451 Natural	456 Blue
452 Yellow	457 Green
453 Orange	458 Turquoise
454 Red	459 Brown
455 Violet	460 Black

Packed in two ounce and sixteen ounce jars. Natural reliefo is also furnished in four ounce jars.

Send for new booklet in colors. Price 10 cents.

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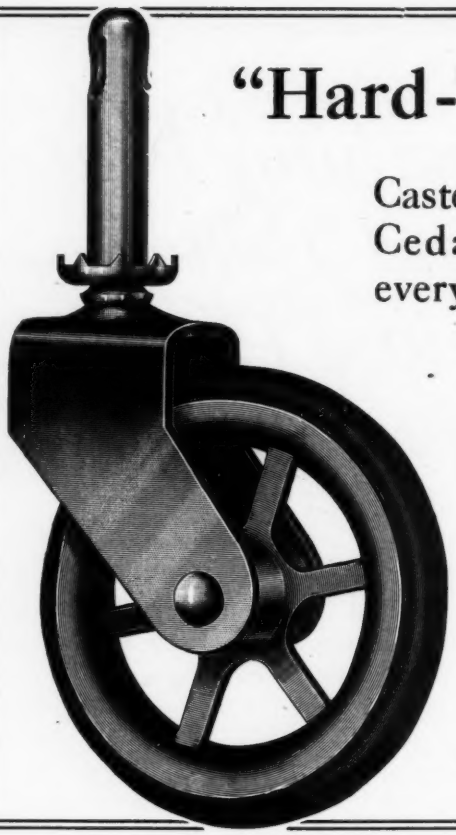
We also manufacture "Old Faithful" White and Colored Chalk; "Prang Crayonex," the wax crayon; "Prang Crayograph," the pressed crayon; "Prang Pastello," the pastel crayon; "Prang" Water Colors and "Prang" Tempera, the new show card color.



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Casters, Knobs, Wheels, Inlays, Cedar Chest Copper, in fact everything to supply the shop.

No Industrial Art Shop is complete without our Catalog and Service.

Send for your copy today

Thurston Manual Training Supply Co.

Jobbers and Manufacturers

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(Continued from Page 28a)

up to 486. A variety of industries was represented by the men in attendance, including manufacturers of automobile wheels, brush handles, drying equipment, electrical goods, lumber, millwork, phonographs, and railroad cars.

Art Poster Contest. A national art poster contest for high school students has recently been announced by the National Safety Council. The poster contest is part of the National Safety Council's program of education in accident prevention and is intended to get the safety idea before the school children of the country. The Council offers 49 individual prizes as well as a beautiful loving cup to be presented to the high school submitting the best group of posters. Fifty of the posters are to be selected for special honorable mention. Information concerning the contest may be obtained by writing to the National Safety Council, 168 No. Michigan Ave., Chicago, Ill.

Picture Study in Schools. As a means of emphasizing the study of pictures in schools, the American Art Bureau, Chicago, Ill., is offering suggestions for those planning picture study. Among these are the selection of a picture each day for study, the selection of an American artist for study, a picture exhibit in each room or school, the selection of pictures and reasons for selection, the forming of organizations for the regular purchase of pictures for the schools, the money to be obtained by subscription, entertainment or other means.

In addition to these suggestions, the Art Bureau offers a short list of pictures for study and a brief list of books for reference in connection with picture study classes.

New Educational Motion Picture Film. "The Story of Sulphur" is the title of the latest addition to the series of educational motion pictures prepared by the Bureau of Mines, United States Department of Commerce. The film depicts the various processes employed in the mining, transportation and utilization of raw material of which 1,220,600 tons were used in the United States in 1924. It illustrates the methods employed in the sinking of wells to sulphur beds, also the Frasch process for lifting the sulphur to the surface. A series of interesting views show the huge vats in which the sulphur are stored and the monster loading machines which pick up the sulphur at the rate of 4,000 pounds at a single lift. Copies of the film may be obtained free of charge for exhibition by schools, churches, clubs, or organizations by addressing the Bureau of Mines, Department of Commerce, Pittsburgh, Pa.

Offer College Course in Mechanical Drawing. Teachers College, of Columbia University, is offering a course in mechanical drawing for teachers in high school. A course in architectural drawing will also be offered.

Announce Fall Art Classes. The School of Design in practical and applied arts, New York City, has announced the opening of the annual fall classes in art. Intensive two-year courses in drawing, painting, sculpture, illustration, commercial art, costume design, fashion illustration, interior decorating, textile design, decorative and applied arts and teacher-training are being offered.

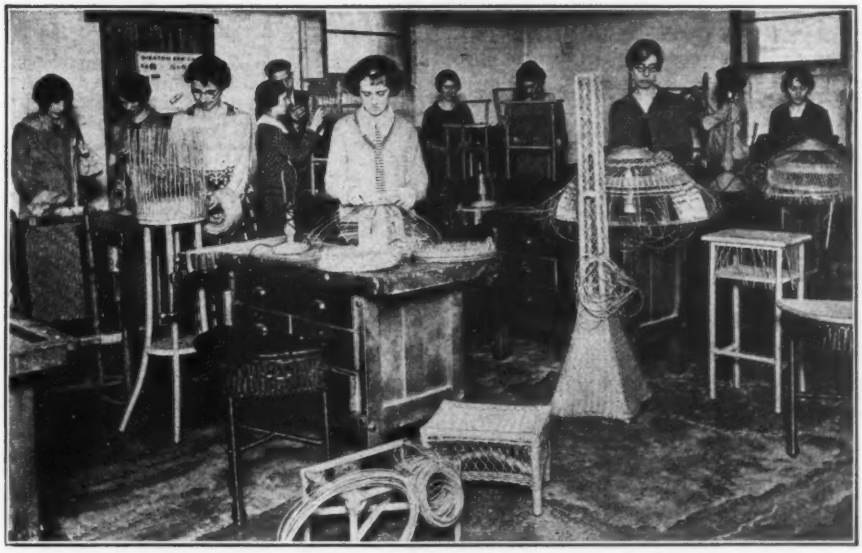
Propose Practical Arts High School. Petitions have recently been presented to the New York City board of superintendents asking for the establishment of a practical arts high school. It is proposed to remodel the old New York Training School for this purpose, and to limit its facilities to girls only.

New Schools for Printing Trades. Two new central continuation schools for the printing trades have been opened on West Fortieth Street, New York City.

Vocational School Opens. The Ranburne vocational high school at Heflin, Ala., opened in September, with the largest enrollment in the history of the school. An additional classroom has been provided at a cost of $1,200.

Evening Classes Open. Evening classes for the 1925-1926 season opened in October, at Hammond, Ind., with courses in dressmaking, cooking, millinery, drafting, show-card designing, machine shop practice, automobile mechanics, printing, and wood-working.

Manual Training Prizes Awarded. A manual training exhibit was a part of the attractions at the Tri-State Fair, held at Superior, Wis. Prizes were awarded for the best displays of sheet metal work, furniture designs and birdhouses. All the pieces were made by boys of the vicinity who had received their training in the shops of the public schools.



Manual Arts teachers in training—one of the several classes in Art-Fibre Furniture Weaving at the State Normal School, Fredonia, New York. Frederick W. Landers, Supervisor, reports splendid results and unbounded enthusiasm.

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BUYERS' NEWS

A Story of File-Making. The Simonds Saw and Steel Co., of Fitchburg, Mass., has recently prepared for distribution among the school trade, a treatise on the history and the steps in the manufacture of Simonds files. The information contained in the story is accurate in detail, of historic interest, and should prove of value to the readers of the Magazine.

The story traces the history of file-making and points out that files are tools of ancient origin, which have come down to the present day in practically the unchanged form. In early days, files were often made of bronze and were of different shapes for different varieties of work. Steel files are of antique origin, as indicated by reference to the eighteenth century French Encyclopedia, which offers a number of illustrations differing in few respects from the modern tool. In the eighteenth century Raoul, a Frenchman, cut files by machinery, and in 1836, a machine was patented in England.

1 - SHEARED - The bar of special analysis steel is sheared to the proper length for the desired file.

2 - TANGED - The tang is carefully formed by drawing one end of the sheared bar to a point, tapering both in thickness and in width.

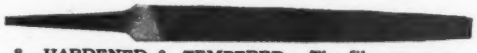
3 - POINTED - The end of the bar opposite the tang is drawn out to length, tapering slightly in width and in thickness.

4 - GROUND - Both sides and edges of the bar which has now the shape of a File are ground perfectly flat and uniform.

5 - OVER CUT - A chisel, operating automatically, cuts the first row of file teeth on both sides of the file. Each tooth deep, sharp, and clean cut.

6 - EDGED - A row of teeth are next cut by the automatic chisel on each edge of the file.

7 - UP CUT - A row of teeth are then cut diagonally across the first row on each side of the file.



8. - HARDENED & TEMPERED - The file now goes through a process which hardens the teeth to a very high degree of hardness, enabling them to cut all other metals which may not be equally hard. The file is cleaned of any scale and is finished, ready for packing. In this case we have a 6-inch flat file.

The present day manufacturer has contended that files of finer quality are made by machinery than is possible by hand. Some special machine-cut files have more than 180 teeth to the inch, with cuts scarcely discernible to the eye. There are files for all kinds of work, but the most common types now manufactured are the mill, flat, hand, round, square, half-round, taper saw, slim taper, and the various styles of rasps.

The Simonds Saw and Steel Company has employed modern methods of file manufacture, with the result that the firm has produced files of a very fine quality. In their manufacture, the firm has used steel of a good quality, which is obtained direct from the Simonds steel mills in bars several feet in length.

After the delivery of the steel in the shop, the first operation is to shear the bars into the required lengths to form file blanks. The tangs and the points of the blanks are formed by means of power hammers, rolls and presses. The blanks are then annealed, after which they are smithed or straightened to place them in proper condition for the grinding machine.

The blanks are then ground on wet grindstones to remove all oxide and scale; this operation also corrects

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minor inaccuracies and gives greater uniformity of shape. With slight irregularities in the surfaces, the blanks are stripped or draw-filed to true surfaces.

The files are either single-cut or double-cut according to their use. The blanks go to a file-cutting machine where the first set of teeth are cut; corners are then struck off on an emery wheel, and the blanks are returned to another cutting machine where the teeth on the edges are cut. The over-cut edges are stripped to remove the sharp edges, after which they go to another machine, and the finishing teeth are produced. The points are cropped or sheared to make files of uniform length, the name is affixed, the blanks straightened and the files are ready for hardening.

In preparation for the hardening process, the files are heated in red-hot lead, taking care to protect the teeth from the lead. Oil and grease are removed by means of a hot alkaline bath, after which the files are covered with a paste preparation to prevent the lead from sticking to the teeth. After heating at a specified temperature, the files are withdrawn and placed in a saturated solution of salt brine for hardening. They are then placed in a sand-blast machine where they are cleaned and scoured, after which they are dried by means of steam.

All files are tested for hardness and the tangs are blued or softened by heating in lead, after which they are cooled in oil. They are covered with a coating of file oil, to prevent rust, receive a final inspection, are wrapped in packages and packed in boxes ready for shipment.

Portfolio for Holding Plans and Specifications. The J. D. Wallace Company of Chicago, has just placed on the market a portfolio for holding wood-working plans and specifications. The portfolio was prepared by Frank I. Solar, of Detroit, Mich., and is intended for use in manual training and vocational classes. It is intended to be used with the Solar-Wallace job sheets, with the idea of having the jobs worked out on Wallace portable machines. The job sheets are of such a nature that they can be easily worked out by junior or senior high schools and they are sent without charge in the belief that they will serve as an excellent course in shop practice. Information concerning the portfolio and job sheets may be obtained by addressing the Wallace Company at 134 S. California Ave., Chicago.

Awarded Large Contract. The American Sawmill Machinery Co., Hackettstown, N. J., has been awarded contract for a number of Woodworking Machines for the University of North Carolina at Chapel Hill, N. C., consisting of Power Feed Rip Saw, Planer and Matcher, Tenoning Machine, Hollow Chisel Mortiser, Jointer, Shaper, Boring Machine and Lathe, including motor equipment for each machine.

NEW TRADE PRODUCTS

New Portable Electric Saw. The Silver Mfg. Co., of Salem, O., has just placed on the market its new Silver portable electric saw, which is a complete, powerful sawmill for cabinet-makers and others requiring a small, compact, portable saw for speedy and accurate work. The saw is suitable for rip-sawing, mitering and cross-cutting, attaches to a light socket, and is readily moved about from place to place. It develops its power and momentum through a patented gear arrangement and a solid forty-pound, accurately and perfectly balanced flywheel, from a motor which is regular equipment.

The precise machine work on all parts of the saw makes it possible to turn out perfect joints in a fraction of the time necessary by the hand-saw method. The cuts are clean and ready to be nailed or screwed in position as the material leaves the saw. The saw will mitre up to 2"x4" pieces to perfect fit at 45 degrees using the graduated mitre gauge—and will mitre much wider pieces by using the sliding mitre gauge.

The swing arm on which the saw is mounted has a swing of nine inches. In addition to this the lumber may be slid along the table by the use of the sliding gauge, thus enabling the operator to saw the lumber to almost any width.

The framework of the saw is a combinaton of iron and seasoned hardwood, firmly bolted together. The entire outfit weighs only 180 pounds and is easily wheeled from place to place by means of heavy iron casters on the legs. Its width permits it to pass through any ordinary door.